
80p
Microdrive File – part 1
YOUR COMPUTER
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JANUARY 1984
BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE
Vol. 4 No. 1
ELAN
EXCLUSIVE – The Elan inside story
PLUS Design your own micro
Big Brothers for 1984: Atari 800XL, Dragon 64, Lynx 96
BBC and Electron software
Oric music
CBM-64 Pyramid of Doom and Vicman
Spectrum and BBC Forths
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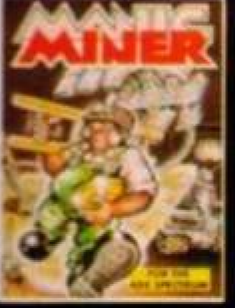


THE BIRDS AND THE BEES

The Birds and The Bees is an original animated cartoon-style game, introducing, for the first time on screen, Boris the Bee. Boris must collect as much nectar as possible, whilst avoiding various nasties like birds, wasps, centipedes and Venus fly traps. Smooth, fast machine-code action throughout, with sound effects, joystick option (most types) and speech option with the Currah Microspeech Unit.

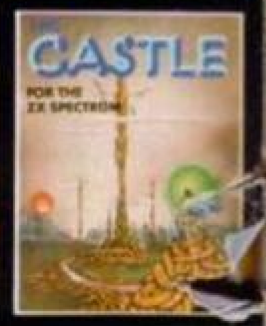
Author: Adrian Sherwin with graphics by Matthew Smith (of Manic Miner fame)

OTHER BEST SELLERS FOR YOUR SPECTRUM









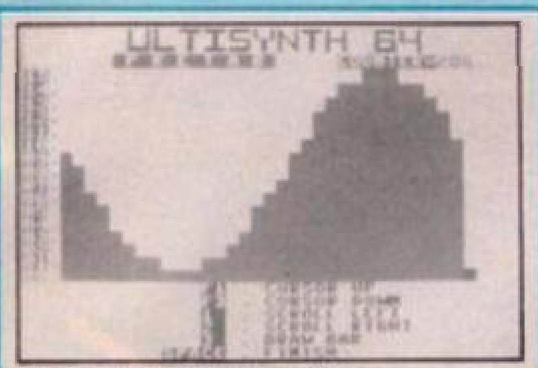
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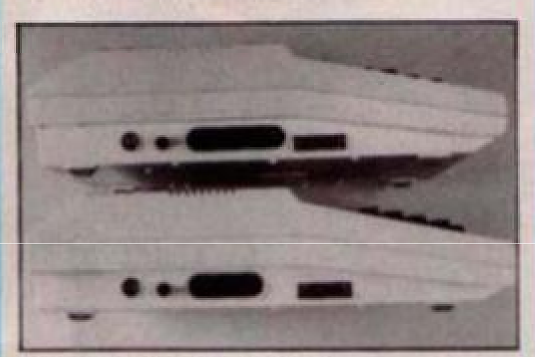
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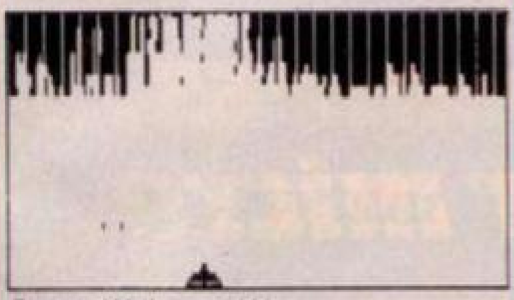
Dealers contact Matthew Thomas on 051-709 7071
Registered Dealers can order direct from CBS Distribution on 01-960 2155

YOUR COMPUTER Contents

JANUARY 1984


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Dragon 64 review: page 70.


Dragon Wall: page 111.


Above: Letter Drop: page 122.
Below: Elan Enterprise: page 78.


Cover photograph by Stephen Oliver



Leave yourself breathless... Turbo-charge your micro

SPECTRUM UTILITIES

BASIC COMPILERS FOR THE ZX SPECTRUM!

Now there are two versions of our best-selling compilers to choose from! Our new 'IS' compiler is the most complete, fast and friendly integer compiler on the market. It will handle strings, full variable names, compile up to 17K of BASIC (48K version), or compile sub-routines to run alongside BASIC or other machine code. THIS IS THE IDEAL PROGRAM FOR CREATING YOUR OWN ARCADE STYLE GAMES! Super fast games involving hi-res graphics and movement are now possible even if you are only knowledgeable in BASIC!

Our fantastic new 'FP' compiler is out of this world. It can handle virtually all Spectrum BASIC, except VAL, VAL$, Multidimensional arrays, and a few other minor features. But it does feature such useful aids as the facility to define and ON ERROR routine, insert machine code in your BASIC, and other non-standard extended BASIC commands. This is the only compiler for the ZX Spectrum able to handle full floating point numbers! 16K and 48K versions of both compilers are available; IS for only **£9.95**, FP for only **£19.95** and you can buy both for the special offer of just **£24.95**.

MODUS 64

NEW!! This fantastic new program for the Spectrum does what many thought was not possible! It turns your Spectrum into a computer which displays everything on the screen in a 64-characters to the line mode. Yes, even TAB now works on a 0-63 basis, and PRINT AT too! There are no special commands to type in. Once activated, it's just like having a totally new computer! Amazing value at only **£5.95**

THE COMPLETE MACHINE CODE PROGRAMMER

Our superb SOFSEM Editor/Assembler and SOFMON Monitor/Disassembler all in one package for a super low price! SOFSEM has been specially created to be specially 'User Friendly' for the beginner, yet very fast and powerful editing, superb labelling facilities, 'status' report, and a 'Help' feature. Quite easily the best Spectrum assembler. SOFMON is equally User Friendly and powerful; featuring the most powerful disassembler on the market, block shift, HEX-DEC, DEC-HEX, MODIFY in HEX or ASC II and a superb feature of disassembling the HEX as entered thus offering 'assembler-like' qualities. Both 16K and 48K versions are on the tape together and are designed to work with Master Key. There is a fantastic booklet included too which introduces the beginner to machine code and also gives an invaluable reference guide for experienced programmers. **£12.95**

THE COMPLETE BASIC PROGRAMMER

Our amazing SOFKIT 1 and SOFKIT 2 in one package.
SOFKIT 1 is a superb toolkit featuring a full renumbering routine, search and replace, variable dump, line deletion and the first ever implementation of TRACE for the Spectrum. SOFKIT 2 is a full-feature graphics kit with smooth scrolling in all directions, attribute search and change, large-letter routine, box creation and a window routine that allows a specific area of the screen to be scrolled independently. The kit also features sprite graphics, cartoon effects, and a full PAINT facility. **£9.95**

DRAGON 32 UTILITIES

MODE 5

Quite simply, this utility radically transforms your Dragon, giving you a new 'mode' in which you can freely mix TEXT and GRAPHICS on the screen. You get true lower case letters, instead of inverse characters, and you can very simply change the character set you are using! It comes with three character sets and is quite 'transparent' to the user. Your Dragon should have come this way! **£6.95.**

Softek's Software is available at most major outlets, including selected branches of the following: W.H.Smith, Boots, Dixons, Tandy Dealers & Selfridges as well as through our nationwide dealer network.
Mail Order Address: Softek International Limited, Softek House, Tranquil Passage, Blackheath, London SE3 0BJ.
Dealers Contact: EMI Distribution, or Nicki Websper on 01.318 5424
SOFTEK INTERNATIONAL LTD. 12/13 Henrietta Street, Covent Garden, London WC2E 8LH. Telephone 01.240 1422

AT LAST, A HOME COMPUTER THAT IMPROVES WITH AGE.



It's surprising how many first-time relationships with a home computer go sour with age.

You buy an attractive, discounted little machine so that you and the children can learn about computers.

Instead, you learn about its limitations: the dull graphics. The plugs that fall out. The cheap power supply. The unalterable "beginners" language. The stiff, fragile keys. No provision for future developments. If only you'd looked around a bit in the beginning... *"Quality costs a little more, but it's usually worth paying for"* (Personal Computer News – CGL M5 Review, June '83.)

The CGL M5 is designed and built by Sord, one of Japan's leading computer specialists, with three main ideas in mind.

First, to be easy and fun to learn and operate.

Second, to be rugged enough to last through hours and hours of operation.

And third, to form the basis of a powerful, versatile home computer system that won't need replacing until you're ready for a dedicated business system.

Built to learn

The CGL M5 is designed to be easy for non-geniuses to use.

"On the M5, most of the work is done for you, and all that is left is the need to work out what to do next, rather than how to do it." (Personal Computer News, June '83.)

If you make a mistake, you can correct it with a simple movement of the cursor. So you only correct that mistake, not a whole line; nor do you have to indulge in complex edit commands.

Budding video game designers and computer artists will love to get their hands on the 16 colour graphics and 32 moveable images called "sprites."

"The M5 makes professional graphic effects very simple for even the beginner to achieve." (Personal Computer World, Aug. '83.)

Built to last

"It works first time, doesn't need a lot of mollycoddling and jiggery-pokery to persuade it to continue to do so, and what's even better, it continues to work well. You don't have to balance cold cartons of milk on the top, shove matches in the back to keep the plugs in, or press the keys with several pounds force to make them respond." (Personal Computer News, June '83.)

Being able to build things that work and carry on working without endless maintenance is something at which the Japanese seem to excel.

Built to grow

To be truly versatile, a home computer has to understand very different things.

So you need different "languages," which the M5 provides by supplying part of its memory in plug-in cartridges.

"The M5 eliminates the worst limitations on machines at this level, which is that they tend to be stuck with whatever language is provided by the management." (Personal Computer News, June '83.)

The computer is supplied complete with a Basic-I cartridge, a standard integer BASIC language and a simple learning text.

Plug in the Basic-G cartridge, and you can access the M5's incredibly sophisticated graphic and sound capabilities which are far in advance of similarly-priced computers.

Move on to the Basic-F cartridge, and you have scientific, technological and statistical computing power usually available only on big computers with equally big price tags.

The FALC cartridge provides a tailor-made language for data management, spreadsheet accounts and business problems. Combine FALC with a disc and you could *"turn the M5 into a small business machine"*. (Personal Computer Magazine, August '83.)

Now, take a look at the back of the M5. Notice the sockets (usually an extra) for a standard Centronics-type printer, the separate video monitor and hi-fi sound output.

Even the language cartridge socket has hidden potential:

"Unlike most such sockets, this one has 56 internal lines connected to it giving access to just about every function in the computer. This means that just about everything you can think of can be added onto the computer, ranging from a Prestel interface to second processor to use as an intelligent terminal on a timesharing computer"... (Electronics – The Maplin Magazine, March '83.)

Take a look at the home computer that will improve with age.

For a full technical specification of the CGL M5, details of the wide range of supporting software and to find out where to see a complete demonstration, send the coupon to: CGL, CGL House, Goldings Hill, Loughton, Essex IG10 2RR. Telephone number: 01-508 5600.

I'd like to know more about the CGL M5. Please send me a brochure and a list of dealers. YC I

Name__________

Address__________



BUILT TO LEARN. BUILT TO LAST. BUILT TO GROW.

DIGITAL CIRCUIT DESIGNER £9.95

Ever spent hours drawing a circuit diagram, transferring it to a breadboard, burning out a few components and having to start again? Laborious, expensive and infuriating? Not any more! Electronics allows you to draw your circuit diagram on screen using standard symbols for logic gates, transistors, resistors, capacitors, diacs, triacs, diodes, etc, etc... Symbols can be rotated, wiring interconnected or crossed over as required. Once complete the computer will 'power up' your circuit - high voltage levels turn red, low levels turn green. Circuits can be de-activated, modified and re-activated until they function as required, all without touching a soldering iron! Part completed circuits may be saved for future work and displays can be sent to the printer. All components are fully interactive i.e. they can change the state of sections previously activated in the sequence - even oscillators can be seen oscillating. Warning is given of short-circuits. (57 defined graphics are employed)

48K SPECTRUM

Spectre

ENFIELD HOUSE
SWARDESTON
NORWICH
NORFOLK

★★★★★

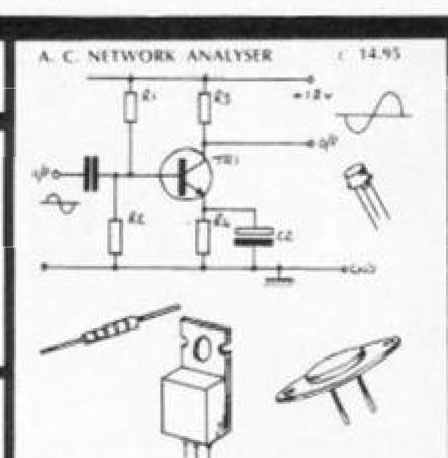
These programs are exceptionally User friendly and have all been written in consultation with professionals in the respective fields. They are all fully menu driven, come with comprehensive written instructions and are fully guaranteed.
Prices include surface postage worldwide - overseas customers requiring airmail please add 10%.
Dealer enquiries welcomed.

PERSONAL DIETARY ADVISOR £6.95



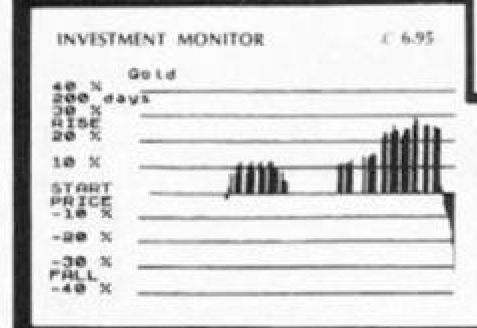
Nutrion is far more than a diet book! Builds up a personal profile based on individual characteristics and lifestyle then monitors food intake. It warns of any potential shortages of any of the essential nutrients, offers advice on suitable foods to restore the balance, advises on your ideal weight, calorie and nutritional requirements and can offer detailed informatio[illegible] the exact amounts of 23 essential nutrients, including calories, contained in 275 different foods. It can be used to plan balanced meals in advance and can operate in both metric and imperial units. Designed to be exceptionally User friendly it can be operated easily by all members of the family.

A. C. NETWORK ANALYSER £14.95



Linnet does for a.c. networks what Electronics does for digital ones! Input characteristics of complete networks, including sub-circuits, are entered. The computer performs either time or frequency domain analyses, presenting the output data in any of a choice of forms, both graphical and written. The program detects the presence of a printer and, if connected, can produce detailed graphical displays by printing lengthways along the paper. Happily deals with highly complex networks - the instruction book provides numerous examples using transistors, I.C.s, bandpass filters, op amps, etc, etc... An invaluable tool for both professional and amateur designers.

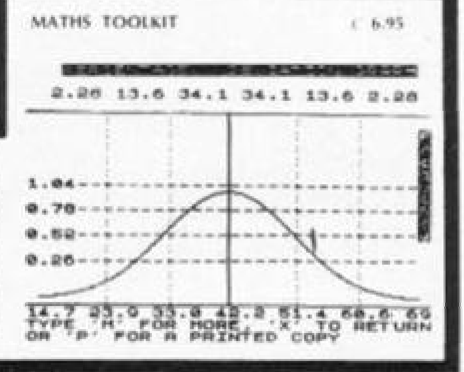
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Numeric can solve or draw graphs of any formula with a single unknown which can be entered via the keyboard. Graph axes can be varied or reversed to suit individual functions. Solves Right Angle Triangles, Simultaneous and Quadratic Equations, Arithmetic Mean, Standard Deviation and Coefficient of Correlation between lists plus Deviation Curves.

MATHS TOOLKIT £6.95



Murder at the Manor

gemtime

Death comes to a quiet country village when the Lord of the Manor is savagely murdered.

The police are baffled with no obvious clues to help them.

Your skills as an ace investigator are required to identify and apprenend the murderer. This will involve searching for clues (which could be dangerous requiring ingenious deductions), examining the scene of the crime and asking questions of the right people.

What is the mystery of the Gravediggers Hut?
What secret does the safe hold?
What lurks at the bottom of the brook?

These may be some of the questions you will ask yourself during your investigation into the **murder at the manor.**

The game is based on a fixed map, comprising the Manor House, the Garden, the Town, the Graveyard and many other fully described locations, inhabited by a variety of individual characters whom you are likely to meet.

Its up to you to solve the murder, the locals may know the answer — but will they tell YOU!

This original adventure fills your 48K Spectrum with over 120 locations, all of which are depicted in full colour machine-coded graphics.

Add sound effects, a full score and save game facility plus a comprehensive and easy to use command analyser (incorporating abreviations and multi-command lines) and you are sure of many exciting and frustrating hours.

WARNING — this is a 4D adventure where night brings added difficulties.

"HIGH RECOMMENDED . . ." POPULAR COMPUTING WEEKLY

Cassette and instruction Booklet
costs £6.95 inc.

GEMTIME, 16 Ben Ledi Road, Kirkcaldy, Fife.

(Trade enquiries welcome)

ORWIN SOFTWARE
ZX81 CASSETTES

"Michael Orwin has built a reputation for value-for-money software and his Cassette 4 offers quantity as well as quality."

Sinclair User, October '82

"If each game was on a separate tape and selling for £5 each I would still recommend them. But all on one for £5 . . ! This sort of value for money just has not been seen before on any personal computer."

"Without sounding pushy I would like to conclude this review by saying — if you have a ZX-81 and like games, then you should buy Michael Orwin's cassette 4."

2 extracts from *ZX Computing,* Oct/Nov '82

"Eight games, including an excellent version of the Scramble arcade game . . . East to operate, graphically impressive and good value for money."

The Times, Saturday 11th December 1982 (about Cassette 4)

CASSETTE 4 — 8 GAMES FOR 16K ZX81 — £6

ZX-Scramble (machine code) with 3 stages
Gunfight (machine code)
Invaders (machine code)
Galaxy Invaders (machine code)
Snakebit (machine code)
Life (machine code)
3D Tic-Tac-Toe (Basic)

"New polich on old favourites . . . the quality of the software and the smooth action displays created on the screen make the programs worth-while for anyone who has a ZX-81 and plays the games using it.

CASSETTE 5 — 8 GAMES FOR 16K ZX81 — £6

Byte-man (machine code)
Space Rescue (machine code)
Breakout (machine code)
Blitz (machine code)
Planetoids (machine code)
Dodgems (machine code)
Draughts (machine code)
Merchant (Basic)

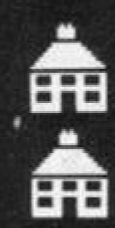
Most of the games include well-presented instructions which make them easier to play. It is pleasant to see that Orwin's kind of quality is available again."
from review of Cassette 5 in *Sinclair User,* September 1983.

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Dept YC, 26 Brownlow Rd, Harlesden, London. NW10 9QL.
ZX81 and SPECTRUM SOFTWARE WANTED
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Colour graphics and sound are used extensively to make learning more enjoyable.

1. TENS AND UNITS ADDITION. You may choose simple sums or sums which involve carrying ten. Helpful correction sequences are provided if mistakes are made. An attractive landscape is formed as the sums are successfully completed, and the scene is animated at the end of the program.

2. TENS AND UNITS SUBTRACTION. Choose simple or difficult sums. Either of the two methods of subtraction taught in schools may be selected at the start of the program. Detailed help is given if errors are made. Correct answers add sections to a bridge. If no mistakes are made, the tank will drive across the completed bridge and fire its gun.

3. PICTURE PLOTTER. This program has been written so that children can create their own pictures on the television screen. It is so simple that even pre-reading children can use it, yet its sophistication makes it suitable for producing multicolour maps and diagrams.

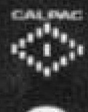
4. NORTH AMERICAN INDIANS. This program helps to develop reading and comprehensive skills. You complete sentences using a word from the list on the screen. Correct responses are rewarded by the creation of an Indian scene which includes tipis and buffalo.

You may replace the questions in this program with your own (create a bank of up to 250 questions with a 48K Spectrum). Any subject area may be chosen.

J. J. Warren 1983
Published by Calpac Computer Software, 108 Hermitage Woods Crescent, St Johns, Woking, Surrey GU21 1UF

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CALPAC LEARNING SERIES
ZX SPECTRUM
VOL. 1
FROM 6 YEARS

CALPAC LEARNING SERIES

PROGRAMS 1-4



1. TENS AND UNITS ADDITION
2. TENS AND UNITS SUBTRACTION
3. PICTURE PLOTTER
4. NORTH AMERICAN INDIANS

SPECTRUM 16K 48K
FROM 6 YEARS

SPECTRUM 16K 48K
FROM 7 YEARS

CALPAC LEARNING SERIES

VOL. 2
FROM 7 YEARS

Colour graphics and sound are used extensively to make learning more enjoyable.

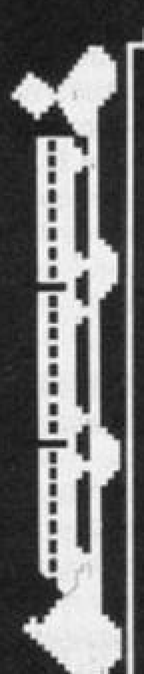
5. MULTIPLICATION TABLES. This program with correction sequences enables you to test individual multiplication tables, or all tables up to a maximum that you choose. Carriages are added to a train as the score increases – see the train glide through the countryside when the test is finished.

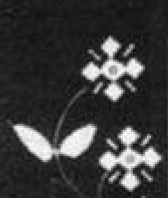
6. THE ROMANS. Answer questions on the Romans to win a horse, chariot, viaduct and temple. Answer enough correctly and the horse will gallop away with its chariot.

7. SPELLING TESTER. The words in the test are initially displayed on the screen. Then short sentences are used as prompts for the words, which must by typed correctly to add stages to a space-ship.

Replace the words and sentences in the program with weekly spelling lists, save them on cassette, and you will rapidly create a whole library of programs.

8. HOMOPHONES. Sale or sail; bare or bear? Choose the correct word to complete the sentence. Extra motivation is provided by a coloured pot-plant, which grows with each correct response. The plant flowers in an unusually tuneful fashion at the end of the program.





CALPAC LEARNING SERIES

VOL. 3
FROM 9 YEARS

Colour graphics and sound are used extensively to make learning more enjoyable.

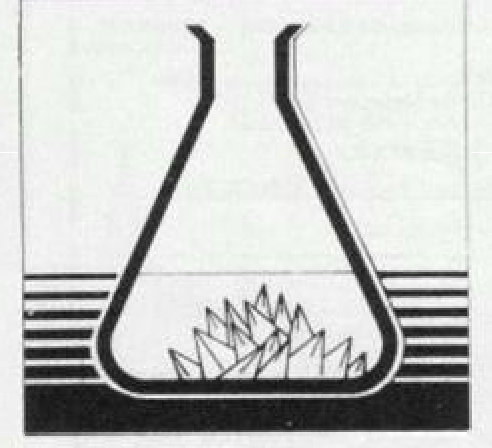
9. NOUNS, VERBS, ADJECTIVES AND ADVERBS. Sentences are displayed and you select the named parts of speech. Instant feedback and helpful comments ensure positive learning. Correct answers are rewarded by the creation of a coastal scene, which is animated at the end of the program.

10. VERB PRACTICE. You have to complete the sentences using the correct tenses of the verbs. The program concentrates on those irregular verbs that often cause difficulty. An underwater landscape is created as questions are correctly answered.

11. THE STRUCTURE OF THE FLOWER. This program explains how the parts of the flower are involved in the formation of seeds. This is a three part program which makes full use of high resolution colour graphics.

12. LONG DIVISION. This detailed program takes the learner through long division sums in easy stages. Correction sequences are automatically provided when they are needed. Sums with remainders can be chosen if required.

SPECTRUM 16K 48K
FROM 9 YEARS



O-LEVEL

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*"Help" call up routine
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Our software is suitable for use in the home, school or college.

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COM 64
Rescue Marion in a British Classic!

ZORGONS REVENGE
ORIC
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GRID RUNNER
ATARI—COM 64—VIC 20
Speed, accuracy and daring amongst a landscape of grids!

ATICATAC
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Do you believe in Ghosts or Monsters—you will now!

BLUE MOON
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Mission base for rescue bid!

SNOOKER
BBC—COM 64—SPECTRUM VIC 20
Physical co-ordination, advanced geometry and applied mathematics—Yes thats SNOOKER!

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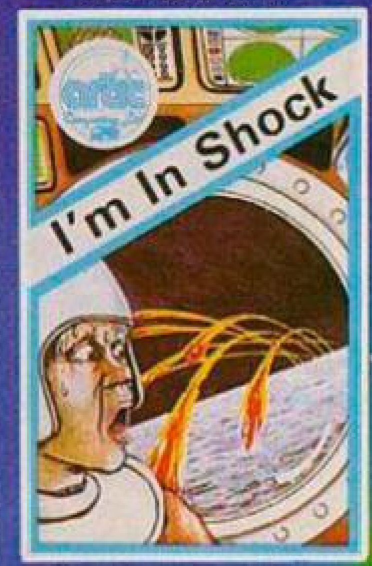
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artic Computing Ltd

FESTIVAL OF FUN!

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Tank Battle

2 *At first, all you can hear is a low, ominous rumbling. Suddenly, you glimpse your first adversary through the remains of the shattered alien city. An exceptional test of nerves and skill for two players.*



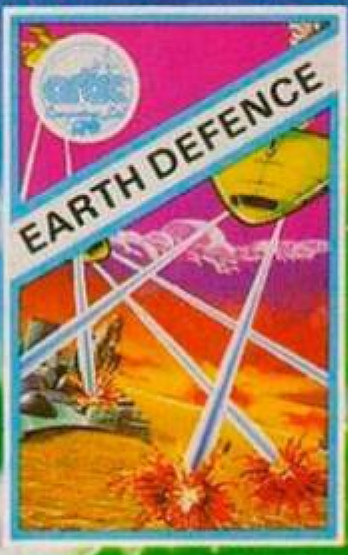
Santa

3 *A space-age compendium of seven original and entertaining games, all with brightly coloured graphics, designed with the young Sinclair user in mind.*



Earth Defence

4 *Wave after wave of incoming alien missiles, hell bent on the destruction of Earth's major cities, set the chilling scene on this unusually addictive arcade game.*



Dear Santa, please rush me these fabulous Artic games. I have put a tick in the boxes of the games I would like. Thank you.

•*Cheque for total amount enclosed £* ______

Please delete or complete as applicable.

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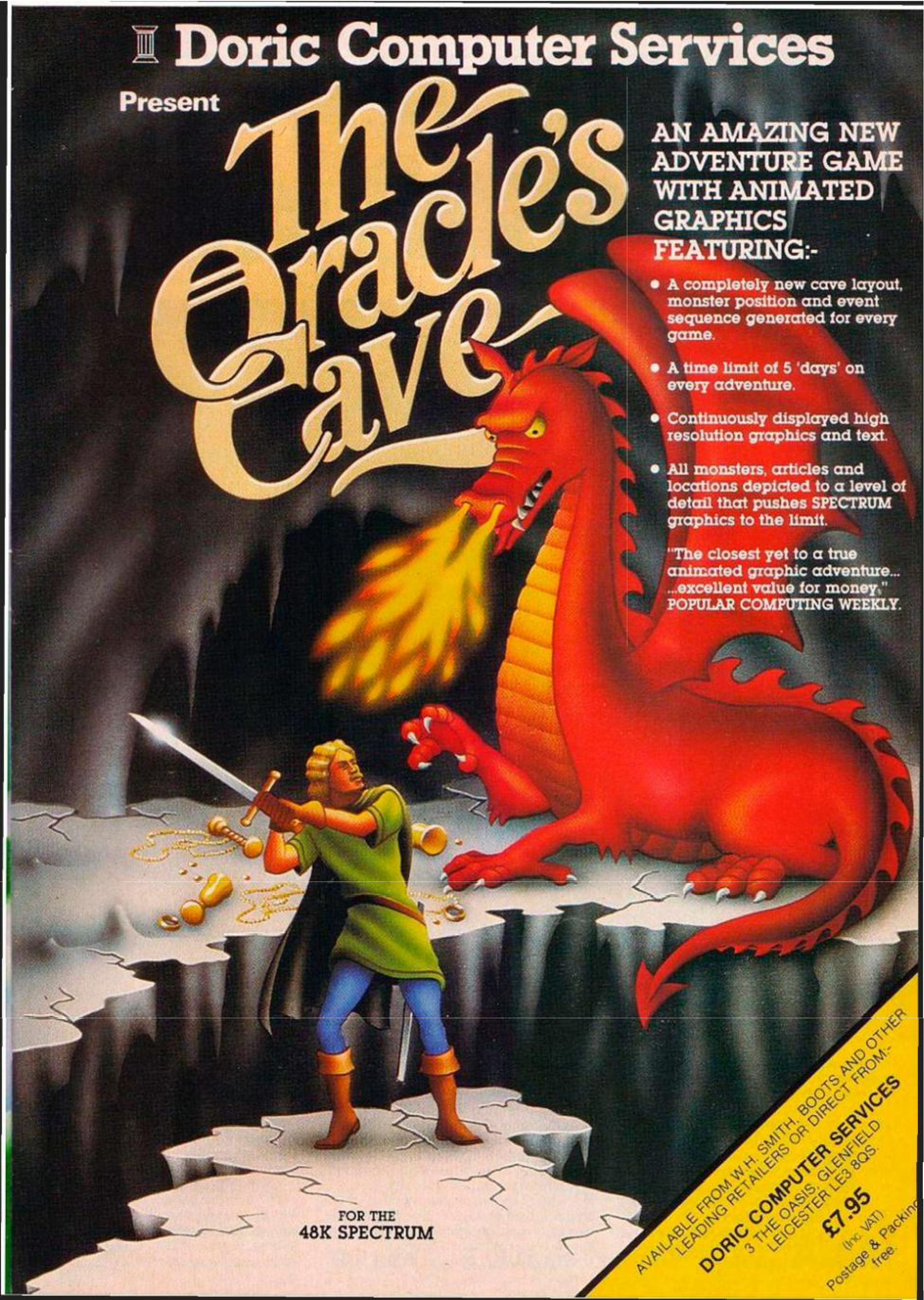
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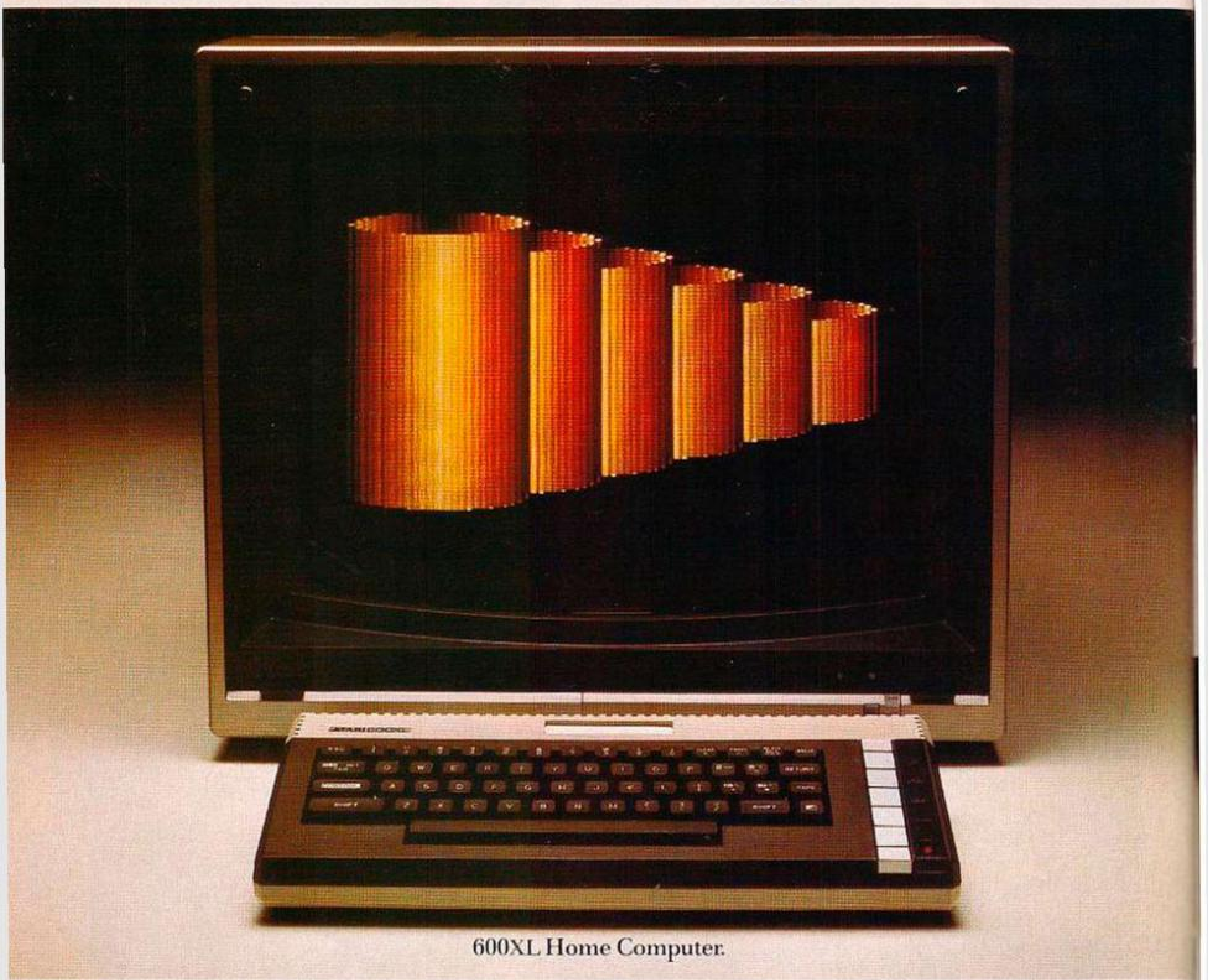
1 I'm In Shock – For any ZX Spectrum £4.95	3 Santa – For any ZX Spectrum £5.95
2 Tank Battle – For any Vic 20 £5.95	4 Earth Defence – For any ZX Spectrum £4.95

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so can your



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ATARI 600XL product specifications.

Colour capabilities: 16 colours and 16 intensities. 256 shades.

Memory: 16K RAM expandable to 64K with memory expansion module. 24K ROM operating system including ATARI BASIC programming language.

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Display: 11 graphic modes. 5 text modes. Up to 320 x 192 resolution. Maximum text display 24 lines by 40 columns.

Special ATARI integrated circuits: GTIA for graphics display. POKEY for sound and controller ports. ANTIC for screen control and I/O.

CPU: 6502C microprocessor. 0.56 micro-second cycle. 1.8 Mhz.

Extended graphics functions: High resolution graphics. Multi-coloured character set. Software screen switching. Multiple redefined character sets. Player missile (sprite) graphics. Fine screen scrolling. Changeable colour registers. Smooth character movement. Simple colour animation facilities.

Programming features: Built in ATARI BASIC programming language plus 8 other languages. HELP key will provide additional information and menu screens. Syntax checking on entry.

Input/Output: External processor bus for expansion with memory and peripherals. 2 controller ports. Serial I/O connector. Monitor output.

Software: Over 1000 items of software available including self teaching programs with unique voice over. Education. Home management. Programming aids. Atari user written programs (APX). And Atari's famous entertainment software.

rience grows
Atari 600XL.



1. Program Recorder.



2. 64K Memory Module.



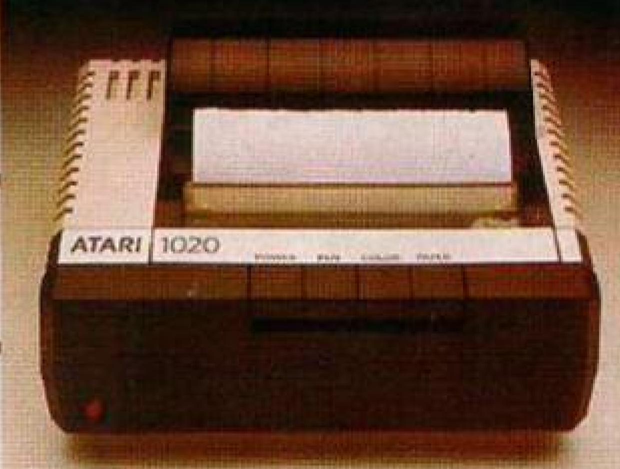
3. Touch Tablet.



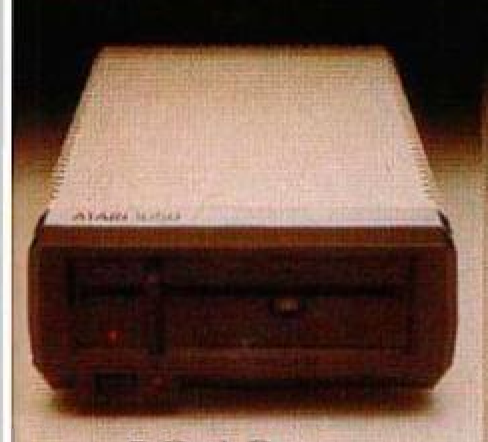
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5. Super Joysticks.



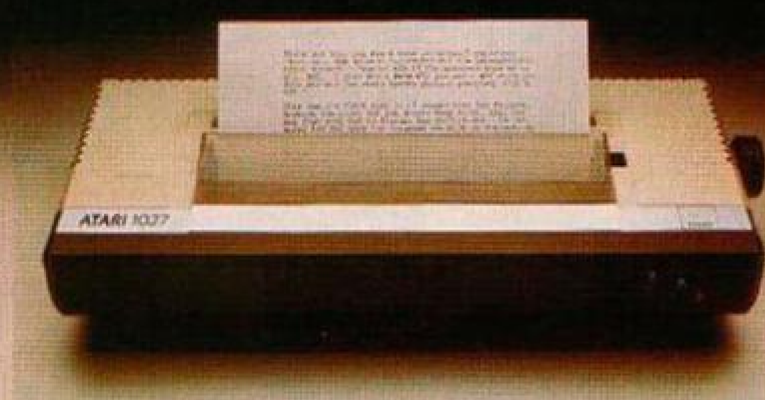
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8. 80 Column Dot Matrix Printer.



9. Letter Quality Printer.

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1. ATARI 1010™ Program Recorder for low cost storage and retrieval capability. Data transmission 600 baud. Storage capability 100K bytes on a 60 minute cassette. Track configuration 4 track, 2 channels (digital and audio). Auto record/playback/pause control.

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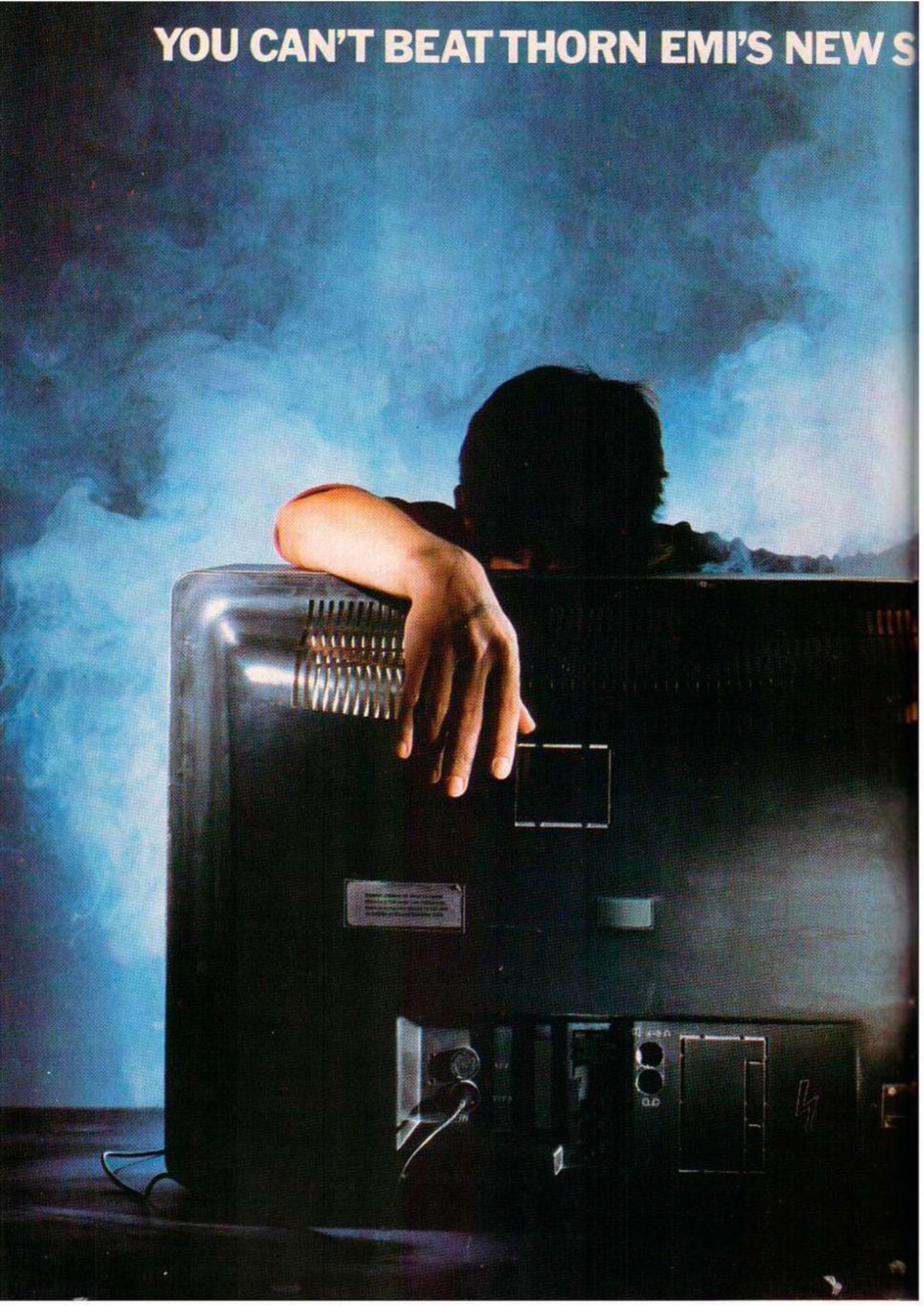
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The new Atari XL home computer system. ATARI®


YOU CAN'T BEAT THORN EMI'S NEW S



What's worse than being lost in space...
IN THE FURTHEST CORNER OF THE GALAXY
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Superchess 3.0 has been developed to bring you the strongest chess program yet for the Spectrum computer.

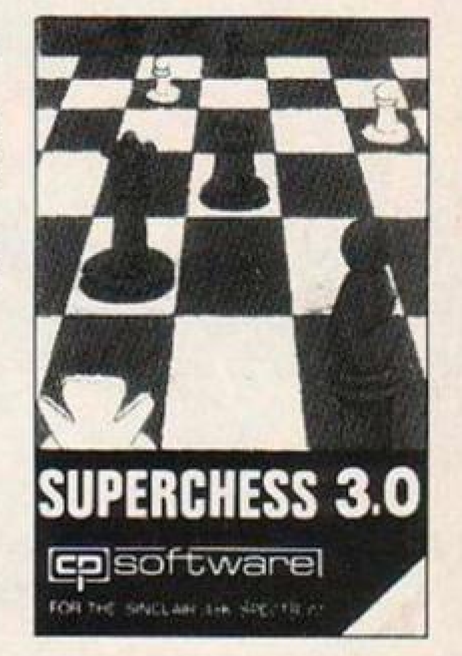
At the tournament level Superchess 3.0 has a look-ahead of five to seven ply (moves) in the middle game, and ten to twelve ply in the end game. This gives Superchess 3.0 a substantial advantage against other chess programs and promises the experienced player an interesting and challenging game of chess.

Unlike other chess programs, Superchess 3.0 is not just a brute-force calculator, but employs artificial intelligence techniques to allow deeper searching along the main lines of play.

FEATURES:

- 10 levels—all play within tournament time limits.
- First level made especially easy for beginners.
- Easy to use—help menus provided.
- Recommended move option.
- Change sides and level during game.
- Self play mode.
- Set up/change position.
- Technical information—how the program 'thinks'.
- Program's internal score for position displayed.
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48K SPECTRUM—Price £8.95



BRIDGE PLAYER

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Dealing—the program shuffles, deals and sorts the cards to produce randomly dealt hands. An almost infinite number of hands are therefore possible, with all kinds of distributions.

Bidding—is in the familiar ACOL system, including Stayman and Blackwood conventions. You bid your hand while the Spectrum bids the other three hands.

Card Play—you play from your own and dummy's hands, which are displayed as they would be at the bridge table, with the program playing the other two hands.

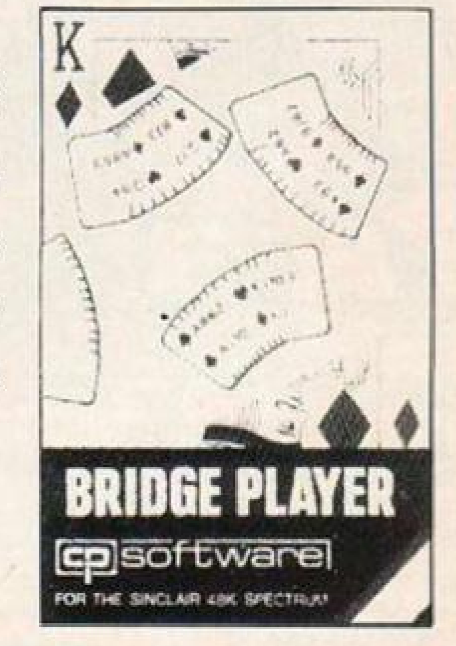
Scoring—at the end of each hand the score is calculated, including honours, slam and rubber points. Both the old and new scores are displayed in the usual manner.

Replay—at the end of each hand, all four hands can be displayed and, if desired, the hand replayed.

48K SPECTRUM BRIDGE PLAYER—£8.95

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SPECTRUM EXTENDED BASIC

—IMPROVE YOUR PROGRAMMING —EASE DE-BUGGING
—HELPS YOU ADD STRUCTURE TO YOUR PROGRAMS

The ten additional BASIC commands provided by Spectrum Extended Basic are considered an essential aid for most programming applications, so much so that many of these commands are standard features on other Basics.

The program is compact, occupying less than 5K memory, is user friendly—requiring only a two key entry—and incorporates syntax checking.

The program commands are used and entered just like normal Basic keywords, the program operates by trapping your usual keyboard input and testing for any of the ten additional commands.

The extra commands available are:

- AUTO — auto line number, start and interval definable.
- CLOCK — ON/OFF 12 hour clock, displayed on screen.
- DELETE — Basic line/block delete.
- EXAMINE — reads tape headers and displays information.
- FIND — find specified string in Basic program.
- MEMORY — displays memory status.
- RENUMBER — full line renumber with GOSUBs and GOTOs
- SCROLL — ON/OFF continuous scrolling.
- TRACE — ON/OFF slows program execution, displays line and statement currently executed.
- VARIABLES — displays variable names and contents.

48K Spectrum Extended Basic—£9.95

SUPERCODE —for 16K and 48K Spectrum

100+ ROUTINES

This is a superior machine code tool kit with one hundred machine code routines that are relocatable for use in your own BASIC and/or machine code programs, the combined user friendly BASIC program, 48k Spectrum only, gives easy access to all routines: • Index of routines. • Call up details of each routine including all information required to tailor the routine to your needs. • Demonstration of how the routine works under software control, the demonstration is repeatable. • Save and verify individual routines. • Comprehensive user guide.

1.	Block Memory Insert	18.	Star Draw	35.	Block Copy	52.	Confuse
2.	Block Line Delete	19.	Flash Switch	36.	Contract	53.	Clarify
3.	Chr$ Swop	20.	Bright Switch	37.	Expand	54.	Space Saver
4.	Chr$ Scramble	21.	Paint Shape	38.	Expand Rem	55.	Screen Overprint
5.	Super-Renumber	22.	Record Sound	39.	Append	56.	Screen Invert
6.	2 Byte Converter	23.	Replay Sound	40.	Count Program	57.	Clear All
7.	Dec-» Hex Converter	24.	Sci-Fi Character Set	41.	Tape Header Reader	58.	Ink Change
8.	Hex-» Dec Converter	25.	Memory Available	42.	Address	59.	Paper Change
9.	Remkill Condenser	26.	Line Renumber	43.	Checker-Board	60.	Flash On
10.	On Error Goto	27.	Uni-Note Sound-Gen	44.	Remove Colours	61.	Flash Off
11.	On Break Goto	28.	Dual-Note Sound-Gen	45.	Display Memory	62.	Bright On
12.	Free-Scroller	29.	Uni-Beep Simulator	46.	Hex Loader	63.	Bright Off
13.	Non-Deletable Lines	30.	Multi-Beep Simulator	47.	Wait-Key	64.	Screen-Print
14.	Border Effects	31.	Screen Fill	48.	Strings to Upper Case	65.	Random Number Generator
15.	Screen Search	32.	Screen Store	49.	Strings to Lower Case		Routines 66-100: Screen routines
16.	Variables Search/List	33.	Screen Exchange	50.	Program to Upper Case		
17.	24-Line Printing	34.	Protect Program	51.	Program to Lower Case		

SUPERCODE £9.95

Also available at Boots, W. H. Smith and all good computer shops.

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DELIVERY:

UK—prices include VAT and postage & packing.

EUROPE—add 80p per program

ALL OTHER PLACES—for air mail add £2 for the first program and 50p for each subsequent program. Surface delivery add 80p per program.

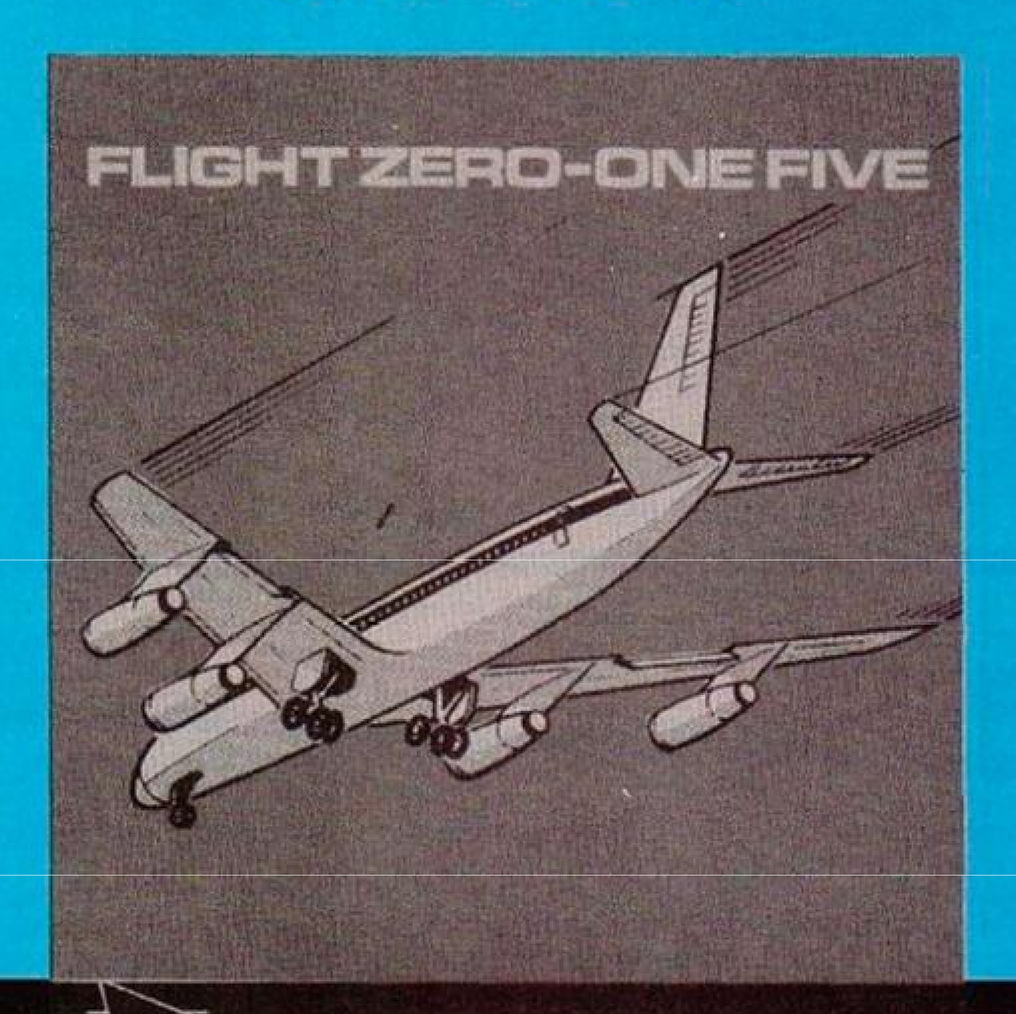


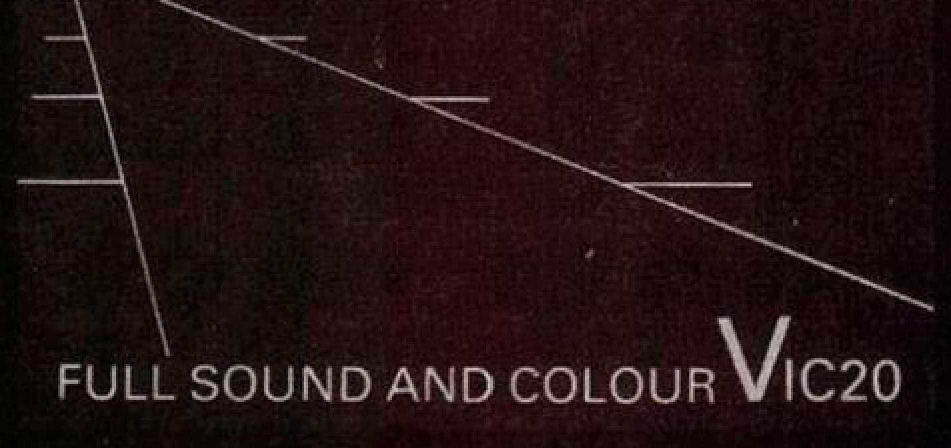
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RESOLUTION	370 x 470 Pixels	580 x 470 Pixels
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E.H.T.	Minimum 19.5kv Maximum 22.5kv	Minimum 19.5kv Maximum 22.5kv
VIDEO BAND WIDTH	6MHz.	10MHz.
DISPLAY	80 characters by 25 lines	80 characters by 25 lines
SLOT PITCH	0.63mm	0.41mm
INPUT: VIDEO	R.G.B. Analogue/ TTL Input	R.G.B. Analogue/ TTL Input
SYNC	Separate Sync on R.G.B. Positive or Negative	Separate Sync on R.G.B. Positive or Negative
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ALL-TIME CLASSIC!
LATE ONE NIGHT THE PIMAN IS DISTURBED BY A VISITOR FROM THE DISTANT GALAXY OF MORRIS MINOR.
CORKS!
I'VE GOT A SHIP OUTSIDE YOU JUST WON'T BE ABLE TO RESIST!
HOW MUCH?
WELL, 'OW MUCH 'AVE YOU GOT?
A POGO-STICK, A SAXOPHONE AND A CAN OF WORMS
WELL THAT'S 'OW MUCH IT IS! SIGN HERE, HERE AN' HERE!
TATTAH, MUGGINS!
OY! I THOUGHT I'D JUST BOUGHT THAT!
LOOK AT THE LOG-BOOK! IT IS I YOU'VE PAID YOUR HARD-EARNED WORMS FOR! BEEP!
EH, WOT?
WHAT DO YOU KEEP STOPPING FOR?
BEEP! CAR-SICKNESS!
CAR PARK
LEMME OUTTA HERE, YA BUM!
NOW TO RETRIEVE MORRIS SO THAT I CAN SELL HIM TO SOME OTHER MUG! GO, MY PHANTOM PHREAKY BIKERS!
I'M FREE! TAKEEEE!!
TOO LATE! THE MAD BIKERS BLAZE IN, LIKE GHOSTS THROUGH THE BRICK WALL...
THIS IS IT
MORRIS meets the Bikers
WATCH OUT FOR......
...TREACHEROUS TIN-TACKS THAT SLOW HIM DOWN...
YOW!
CREEPY CARBON MONOXIDE...
LOONY LIFTS
ELEVATOR
PRECIOUS PETROL
GRRR!
AND CLINGING WHEEL CLAMPS THAT BRING HIM TO A GRINDING HALT...
AND HAS TO COLLECT TEN GOLDEN COINS BEFORE HE CAN ESCAPE THROUGH THE EXIT TO THE NEXT SCREEN. THERE ARE 9 SCREENS ALTOGETHER, BEFORE HE IS FREE!
MAYBE WE DON'T LIKE THE NOISE HIS HORN MAKES, AN' MAYBE WE CAN'T GET HIM IN THE LIFTS - BUT WE CAN FLY THROUGH WALLS, AN WE DON'T CARE ABOUT NO HAND-SIGGERNALS OR DOUBLE-YELLER LINES! HAR HAR!!
SO WHAT'S AUTOMATA GOT IN THE WAY OF CLASSIC ENTERTAINMENT? HOW ABOUT THE DIFINITIVE VERSION OF THAT BOARD GAME!
HEH HEH
GO TO JAIL
AND IF YOU CAN'T FIND ANY HUMANS TO PLAY AGAINST, WE DARE YOU TO PLAY YOUR..
..COMPUTER!
BUT BEWARE..
IT MAY WELL WIN!!
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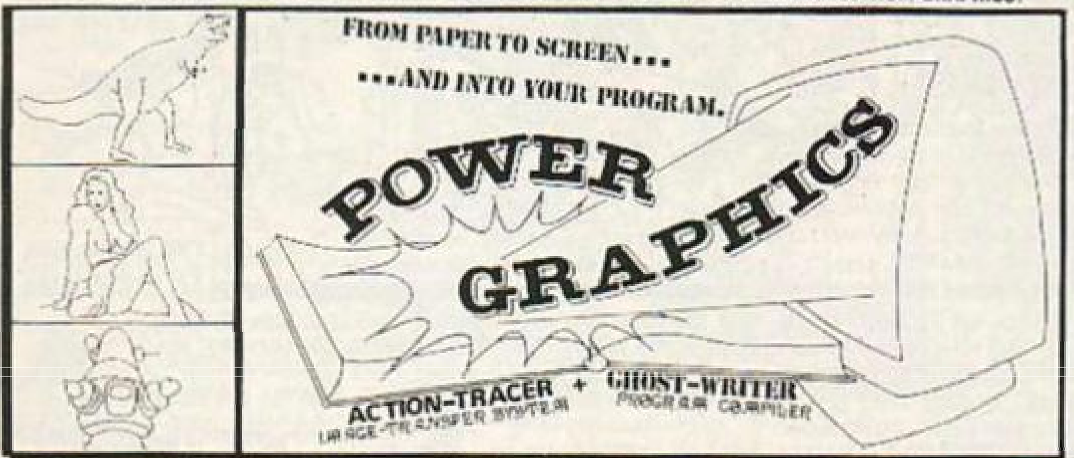
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TWO POTENT FEATURES COMBINE TO BRING YOU UNIQUE NEW POWER OVER YOUR SPECTRUM GRAPHICS!



● ACTION-TRACER Gives you the power to transfer drawings, photographs, paintings, lettering — in fact ANY paper-based images into full colour line-drawings on your Spectrum screen, with astonishing ease and an accuracy that rivals expensive digital tracers. But this time you get more than just a static on-screen design that has to be laboriously droned on and off tape, because . . .

● GHOST-WRITER Interprets your on-screen design into the precise sequence of basic instructions needed to EXACTLY reproduce it, and then writes the program for you, directly into memory! New program lines appear in your listing which are indistinguishable from ones you might have written yourself. When you've finished, POWER-GRAPHICS will 'self-destruct', leaving behind only your new program lines ready to use.

TOGETHER THEY'RE DYNAMIC!

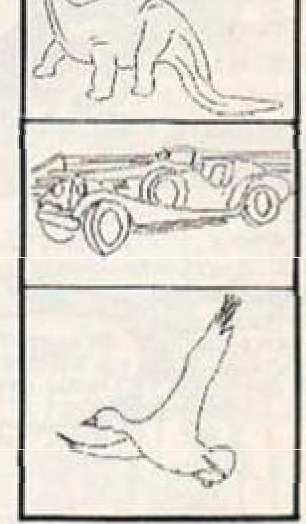
The new program captures your design DYNAMICALLY, giving you instantly the power to MOVE it anywhere, to SHRINK it down to a single pixel, or EXPAND it to fill the screen. You can SQUEEZE or STRETCH it into weird distortions, flip it UPSIDE DOWN or MIRROR-IMAGE it, ROTATE it in the plane of the screen . . . in other words MANIPULATE IT UNDER YOUR FULL CONTROL!



Once GHOST-WRITER has captured Space-Shuttle, you can immediately reproduce it anywhere, any size, AND redesign it too!

No problem producing mirror-images . . . and turning them upside-down is just as easy, too!

Drawing a simple cross-section (above left) and rotating it through the plane of the screen to produce exotic architecture is just a peep into a whole new world of exciting, inventive graphics made easy as ABC by GHOST-WRITER's versatile programming.



MANIPULATION OR ANIMATION – GHOST-WRITER ALWAYS WRITES EXACTLY THE PROGRAM YOU NEED!
You can tell GHOST-WRITER to program selected parts of your design with their own special line numbers, allowing you to call them as separate sub-routines. Thus you can add or remove parts at will – like the Bunsen burner in this chemistry diagram.

INSTANT FORGERY!
How would you like to write a program that signs your name exactly as you do yourself?

John Smith

It's just a few minutes' fun with POWER-GRAPHICS!

Animating the lips of this well-known newsreader (recognise her?) is just as simple – and thanks to POWER-GRAPHICS' ability to produce high-speed curves when needed (which draw as fast as straights) her curved lips can be animated in real time!

POWER-GRAPHICS is fun to use, simple in operation, and for beginners and advanced users alike is an important new programming tool that extends the Spectrum's potential for imaginative graphics into exciting new regions.

IF YOU WANT PICTURES YOU CAN USE, IT **HAS** *TO BE POWER-GRAPHICS.*

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sinclair special

6



Inside...

Setting new standards in educational software with Sinclair-Macmillan

Plus six other learning programs

TODAY, LEARNING IS A NEW GAME

Subsidised microcomputers are now commonplace as teaching aids for the very youngest children and the ZX Spectrum is prominent amongst those micros at use in schools.

In the relatively short time that the Spectrum has been at work in the classroom, two questions have been answered. Yes: with the right software, the micro can and does teach effectively and thoroughly (and gives teachers more time to devote to individual pupils). Yes: young children think little of working rapidly and successfully, with a screen and keyboard, on even quite complex subjects.

In this Sinclair Special we reveal a range of educational software specifically designed to make full use of these advantages. The programs produced by Sinclair in collaboration with Macmillan Education are fascinating. They deal imaginatively and most effectively with early reading skills and take a truly refreshing approach to basic science.

In the Blackboard range we've programs which bring a light-hearted clarity to the tricky matters of spelling and punctuation.

These programs are designed for use both at home and in the classroom. Each program is accompanied by full documentation which gives parents helpful advice and guidance on the educational objectives.

The programs covered on these pages represent only a fraction of the full and fast-growing list of Spectrum software. Be assured we'll keep you in touch with new developments as they happen.

David Park

David Park
Education Marketing Manager

NEW WAYS TO LEARN WITH THE ZX SPECTRUM®

Programs from Blackboard Software

The new range of educational programs from Blackboard Software makes learning an enjoyable process by involving the child in a game which teaches as it entertains.

Each program has a step-by-step example section and gives correct answers after a number of attempts. Vocabulary changes can be made, allowing each program to keep pace with the child's development. This flexibility can also be used in the classroom to cater for children of differing ability.

The instructive and colourful games which follow the successful completion of each group of sentences provide useful practice in letter recognition and increase familiarity with the Spectrum keyboard.

All programs are written for the 48K RAM Spectrum.



Alphabet Games

Three games of letter recognition (using either upper or lower case) to help children learn the alphabet and find their way round the computer keyboard.

Alphagaps – The full alphabet is displayed, along with a second, incomplete version. The child must fill in the missing letters.

Random Rats – Press the letter key that is displayed on the gun to destroy the rats which have invaded the cellar!

Invaders – Stop little green men from landing on Earth by pressing the appropriate letter.

Early Punctuation

While an animated matchstick man marches above displayed sentences the child must decide which punctuation mark is missing and where to insert it. At the touch of a key the matchstick man drops the mark into place. After successful completion of every sentence in the exercise, light relief comes in the form of a bottle-shooting game!

The Apostrophe

As each sentence is displayed, a bird appears with a worm in its beak. The keyboard is used to move the bird and drop the worm into the correct place for the apostrophe. When ten sentences have been corrected, the Grub Game is displayed. Press the correct character to change the grub into a butterfly...before it munches through a flower!

Capital Letters

A program to teach the use of capital letters. Sentences incorporating proper nouns and sentences without opening capitals are displayed. The child inserts the correction by guiding an animated figure to the appropriate letter.

For each correct answer an apple grows on a tree. After ten correct answers the child's skills in recognising letters and using the Spectrum keyboard are needed to save the apples as they fall to the ground.

Speech Marks

A comprehensive program including sentences with one or two sets of speech marks ("inverted commas") and exercises in both direct and reported speech.

Using the Spectrum keyboard, a cursor is used to guide speech marks to the correct position. The program offers three levels of difficulty, with full examples for each section. Guide Max the mouse through a maze, after the correct completion of five sentences from each section, but beware of Persian cats!

Castle Spellerous

A spelling game with ten levels of vocabulary, including words with silent first letters, double letters and other difficult words. The Princess has been captured and carried off to Castle Spellerous. Helped by ten soldiers, the child can attempt a rescue by giving the right answers. Part of a siege tower is built for each correctly spelt word. Mistakes are costly – the wicked wizard appears as a vampire bat, turning the men into frogs, butterflies and bats!

When ten words are spelt correctly the rescue begins and the wizard takes flight.

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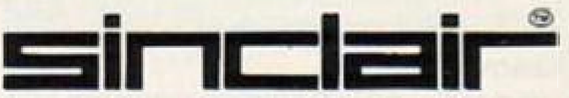
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This was exactly as intended but unfortunately *something went wrong*. During the programming strange uncomplimentary messages began to appear on the screen. At first they were so few they were not taken too seriously, but soon they could no longer be ignored. Somehow the Spectrum had been given a personality — a rather devious, supercilious, dislikeable, hateful, horrible mind.



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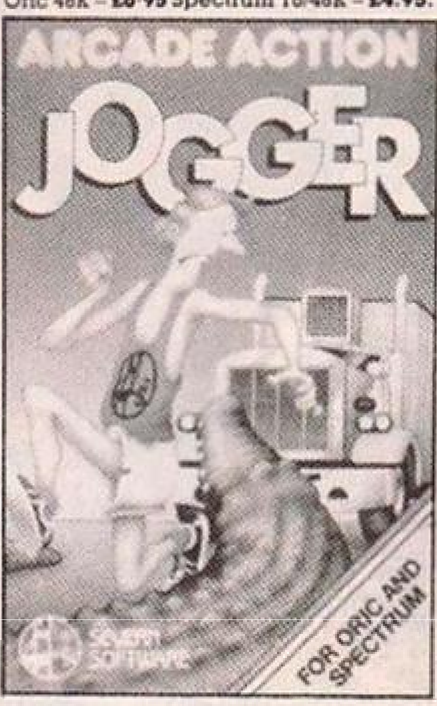
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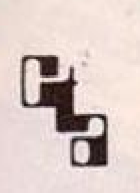
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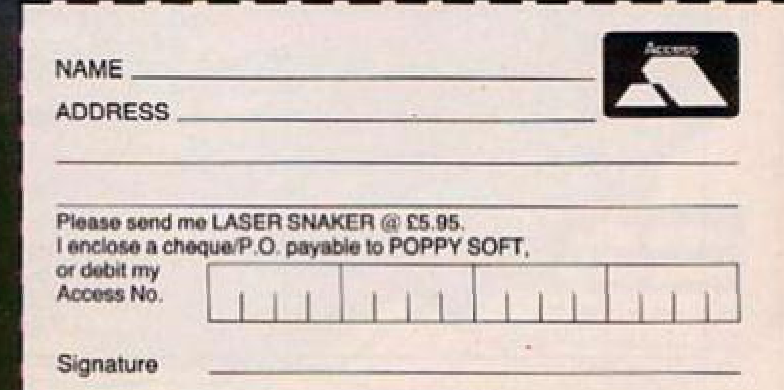
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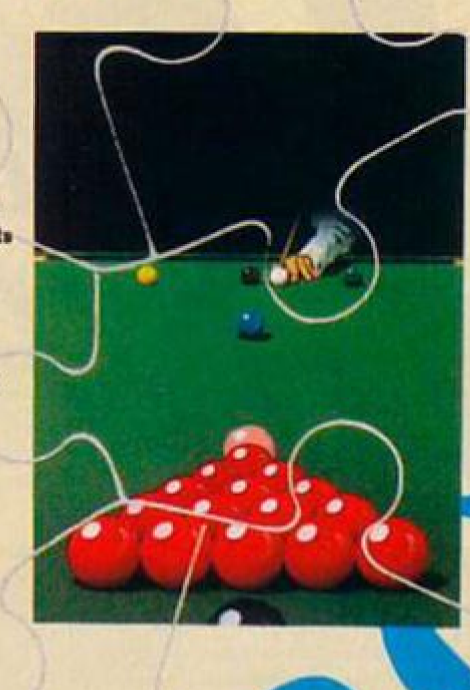
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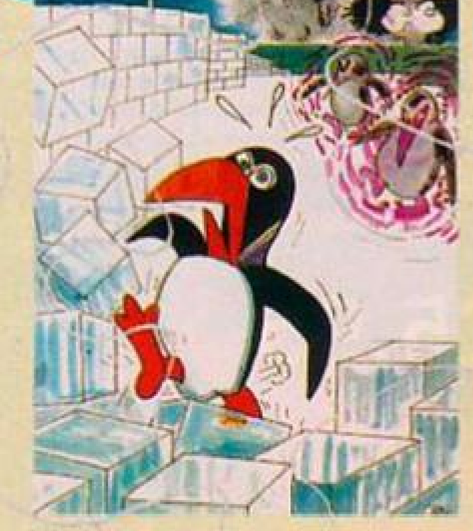
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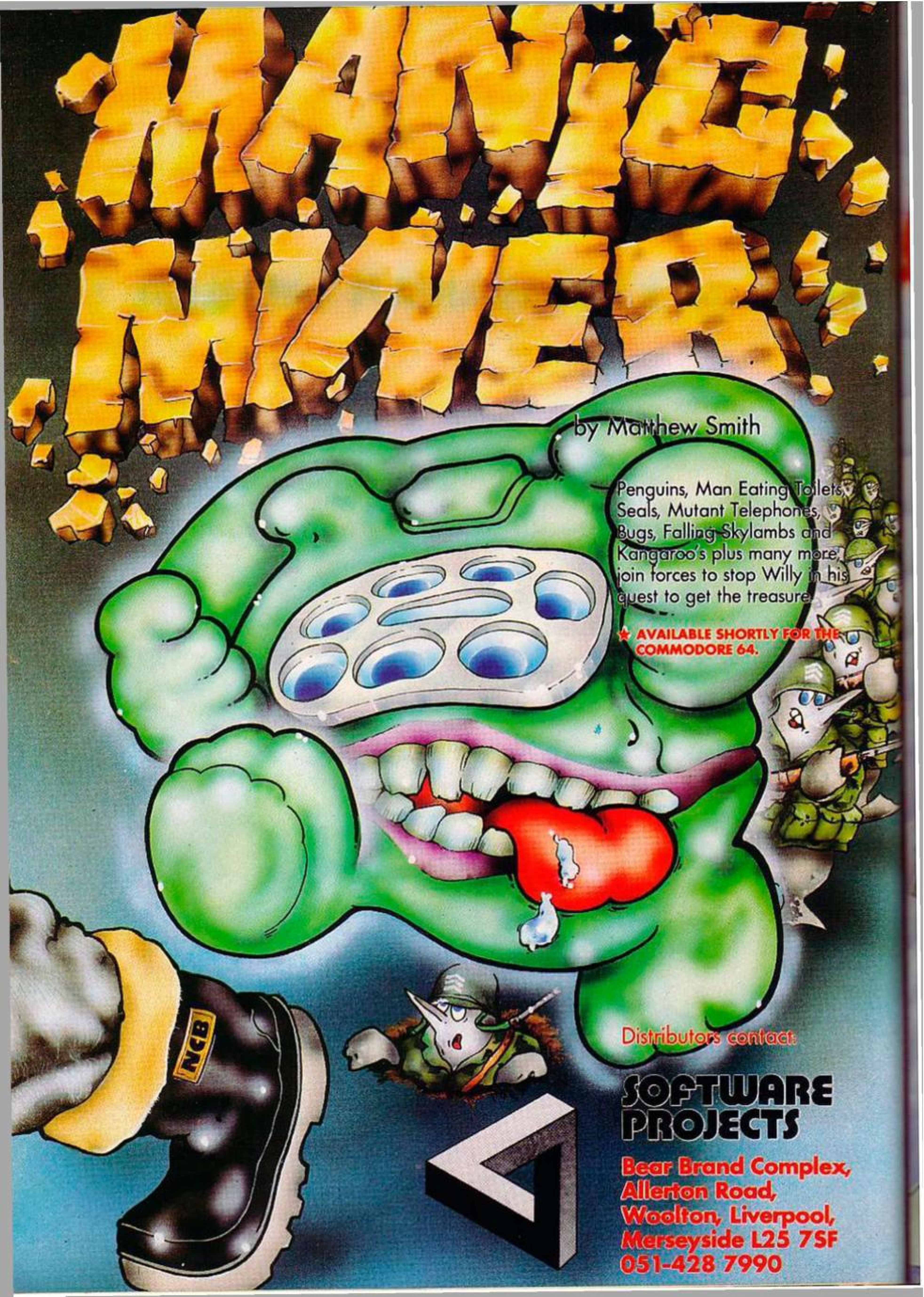
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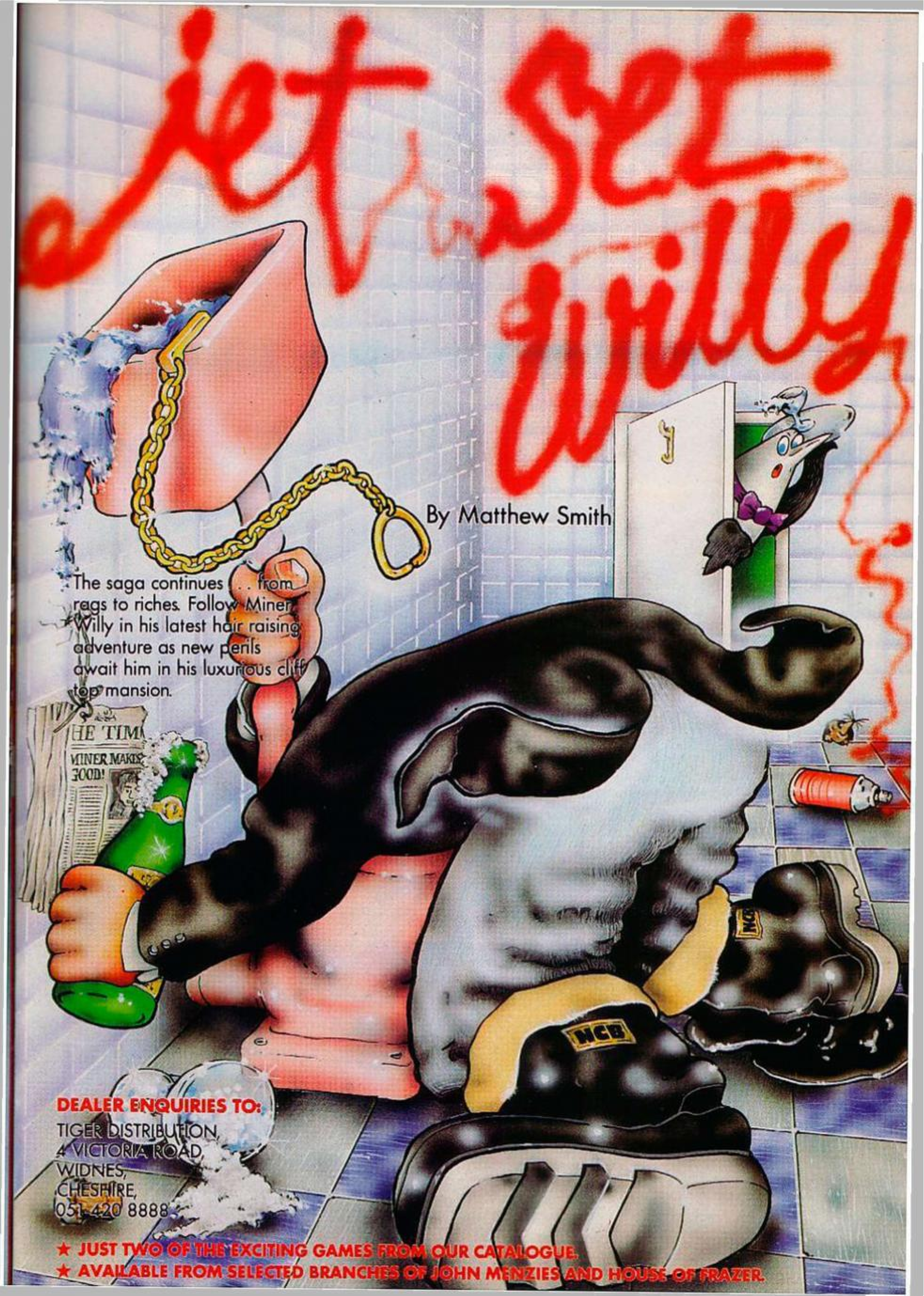
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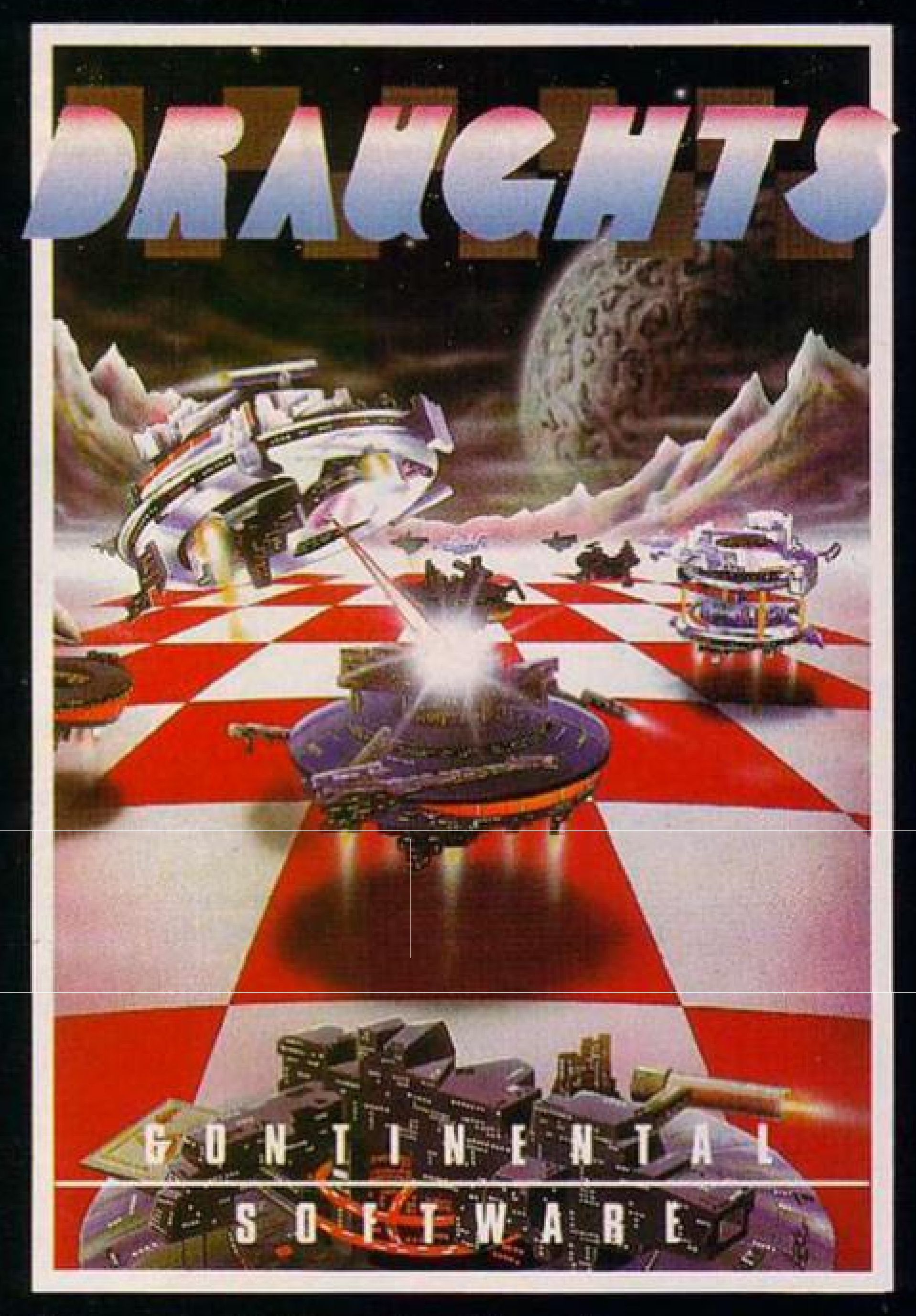
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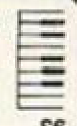
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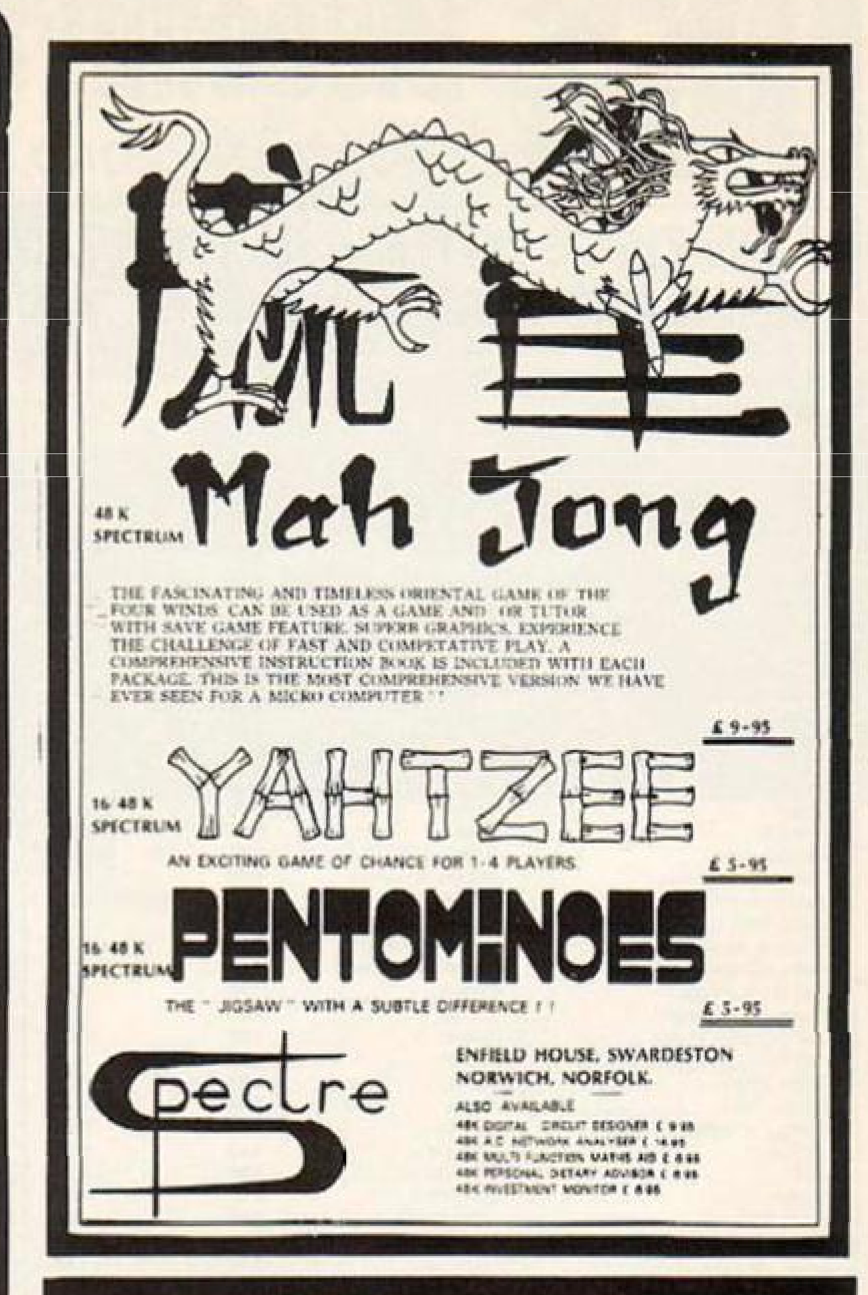
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BURGLAR PROOFING THE BBC MICRO COMPUTER

Having been puzzled for some time as to how some Basic programmes have been protected so as to be unlistable, I set to work to try to devise a way of making my own programmes unlistable.

It works by searching through programs for Rem statements. When writing programs you have to insert a

:REM@@@@

statement after every line you wish to be hidden, so that when my utility is run, it jumps to the procedure on finding a Rem — code &F4 — followed by an

@

— code & 40. This latter character acts as a double check so that spurious &F4s are not treated as Rem statements — this can happen, as I found to my cost while developing the program. It then proceeds to insert the value of &0C in each statement up to the end of line marker — &0D-return. Code &0C is the code for deleting the text area. Another advantage is that you can still have genuine Rems to help you out.

You can alter the program to insert any control character you like, but I favour &0C. So when the program you have Remmed is listed, the computer gets the code to clear text, and does so, preventing you from seeing it. Excellent for hiding Data statements as well as program protection.

I initially tried the backspace and delete code — &7F — but this required Rem statements the same length as the line to be deleted, and was consequently too greedy on memory.

Other useful control codes to insert in Rem statements include &03, which disables the printer, and further prevents listing. It cannot, however, be used after an OS * command. Even if people don't want to make their entire program unlistable, they can Rem a few key lines containing variables or machine code calls, hide them from prying eyes and yet allow their program to run perfectly.

One of my favourite and most devious tricks is to Rem lines above and below lines which disable the Escape key, cause memory clear on pressing Break(*FX200,2) and lastly have the entire program deleted on error — after inserting a hard-to-find error at the end of the program. You can make Rem lines disappear anywhere within a program, and they're a devil to locate. Best technique is to number your program with odd lines, and then AUTO number evenly, inserting

REM@@@@

at every even line.

Best way to use the deleter is to *spool it with high line numbers and then *EXEC it into a program. It can self destruct by use of the On Error Delete command.

Peter Lee, Mexborough, Yorkshire.

```
BBC Model B 1.2

19000REM"DELETER V.0.4"
19010 B%=TOP-&E9:F%=&1900

19011REM Setting B% stops the utility
     searching through itself

19020REPEAT
19030B%=?F%
19040C%=?(F%+1)

19041REM C% is the location after
     &F4,which on containing &40
     (return) move to the procedure

19050IFB%=&F4 AND C%=&40 THEN PROCdelete

19051REM if it's a REM followed by @,go
     to procedure to insert control
     codes

19060F%=F%+1
19070UNTIL(F%)=B%
19080P."Finished":STOP
19090DEFPROCdelete
19100F%=F%+1
19110IF?F%=&0D THEN ENDPROC

19111REM if end of line leave procedure

19120REPEAT
19130IF?F%=&0D THEN ENDPROC
19140?F%=&0C

19141REM insert clear text code

19150F%=F%+1
19160UNTIL ?F%=&0D
19170ENDPROC
```

SKYSHIELD

Concerning the December issue Sky Shield program. There are six numbers missing as follows.

ADDRESS	VALUE
10240	134
10241	8
10242	61
10243	195
10244	48
10245	0
10246	31

Without these numbers the program will probably crash.

Andrew Richards, Haywards Heath, Sussex.

MERGE PROBLEM

There was a slight error in my ZX-81 Merge program published in the November issue. The machine code itself was free from errors but the addresses along the left hand side of the hex dump were wrong. They should have started at 16514 and increased in increments of 8, finishing with address 16794 instead of 16802.

Those of you who have typed in my ZX-81 Quick Load program — June's issue — may find the following modification useful. It allows you to merge programs which have been saved at high speed using the quick load program. Type the program in as listed and, just before Saving, enter the following:

```
POKE 16622,0; POKE 16623,0;
  POKE16625,3; POKE 16646,61;
  POKE 16709,0
POKE 16711,15; POKE 16712,28;
  POKE 16716,0; POKE 16717,0;
  POKE 16724,254
POKE 16725,25; POKE 16726,56;
  POKE 16727,229; POKE 16728,254;
  POKE 16729,62: POKE 16661,1
```

It is possible to have both the quick load and merge programs in memory at once since the former is contained in a Rem statement and the latter resides above RAMtop.

Richard M Taylor, Suffolk.

ORIC SOUND

May I please point out to Piers Letcher, concerning his article the Sound of Micros, in Novembers *Your Computer*, the mistakes he made in the information about the Oric.

First, he said that the Oric has only one channel of sound when Oric actually has three. This can easily be proved by typing in:

```
MUSIC 1, 3, 1, 8: MUSIC 2, 3, 5, 8:
MUSIC 3, 3, 8, 8:
PLAY 7, 0, 0, 500
```

This quite clearly gives as three note chord.

Secondly, he placed an x under the white noise column. The Oric can in fact produce white noise and Piers may have realised his mistake if he read S. Tighe's letter which among other things pointed out that

CALL #FB11

gives white noise on the Oric.

Thirdly, Piers had an x in the Envelopes column. If he had read the sound chapter in the Oric manual he would have known that there is both an Envelope Mode and an Envelope Period.

Ian Messenger, Whitehaven, Cumbria.

MEMOTECH MEMO

We would like to offer the following amendments to your very interesting article on "£100 -£400 Micro Survey" in *Your Computer*, December 1983.

Memotech produces two versions of the MTX computer: the MTX 500 retailing at £275.00 inc VAT and the MTX 512 retailing at £315.00 inc VAT with user addressable RAM of 32K and 64K respectively.

Both machines contain 16K of dedicated video RAM over and above the user RAM, which in essence means that the user RAM is not reduced with increasing graphic resolution. On board RAM may be expanded internally up to half a megabyte on both computers.

Furthermore, there are numerous game titles available at present from Continental Software. Readers may write direct to them at Unit 23, Station Lane, Witney, Oxon, for a colour catalogue.

Memotech Limited, Witney, Oxfordshire.

VOICE OF SINCLAIR

It has come to our attention that a minority of programs available on the market do not work with the Issue 3 Spectrum which has recently been released.

In accordance with our policy of constantly improving our products, we have from time to time made changes to the Spectrum. We have always taken care that such changes neither conflict with published documentation nor alter the normal operation of the Spectrum. However, some software developers have apparently made an assumption about the Spectrum which is completely unsupported and

NOT SO ADVENTUROUS

With reference to the letter from J Musson in November *Your Computer*, I disagree with his point of view insofar as Pete Connor's selection of software was a good representation of the adventure games available, and a large proportion of current adventures are worth less than the cassettes they are recorded on. The five games that Mr Musson judged as being good may be towards the better end of the market, but what is the point of reviewing only the good software?

He delivers a critical judgement of Level 9's Colossal Adventure — it is as if he never set eyes on this program in his life. Perhaps it is worth noting here that Colossal is a version of the original adventure by Crowther, and has a substantial following throughout the word in its many implementations on the more expensive systems.

The main point that Mr Connor makes is that the standard of adventure is very low, and that for every good program there are 20 bad. What Mr. Musson can find to quible about in that is beyond me.

A Taylor and A Heading, Edinburgh.

undocumented by us. They have assumed that the values in the three high order bits when a byte is read in from the keyboard using the N command, will always be equal to 1.

In the Sinclair ZX Spectrum Manual, chapter 23 page 160, it states that bits D0 to D4 stand for the five keys in the half row being read. D6 is mentioned as being the value at the ear socket, while D5 and D7 are not mentioned. The correct way to read this byte is to mask out the three unused bits, so that it is certain that their value is either 0 or 1. The value of the complete byte can then be tested safely as the only variable will then be the area relating to the keys.

To assume that bits D5, D6 and D7 are always high has always been extremely unwise as this is not necessarily so in any Spectrum. In Issue 3 Spectrum, however, the effect has become more noticeable as bit D6 is set to 0 when there is no signal coming from the tape recorder.

I must emphasise that, in our view, it is extremely dangerous programming practice to assume the value of a bit which is essentially unstable, and we strongly recommend to software houses that they re-issue masters for any programs which make assumptions of this kind as soon as possible.

Alison Maguire,
Software Manager,
Sinclair Research.

PROGRAM BUG

The Spectrum Assembler in your November issue acquired a bug during the final "tidy-up" that will cause instructions of the form LD (HL), reg to be rejected. It is easily corrected by merging the packets from line 816 — between "" and 'nn' — into line 817 and deleting 816. All tape copies are correct, and a now unlimited number of copies is available — still only £3 each — as I have engaged the services of a professional tape-duplicating firm to meet the demand.

The assembler converted very easily onto my Microdrive

David J Hawkins,
Trowbridge,
Wiltshire.

Explanation of graphics characters in the first listing of Swag on page 126.

All ↓ are inverse as are all items underlined. In quotes in line 110 note that there should be 21 ↑ signs, 3 ↓ signs, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 3 ↓, 1 ↑, 4 ↓, 2 ↑, 1 ↓, 3 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 5 ↑, 3 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 3 ↓, 1 ↑, 1 ↓, 1 ↑, 2 ↓, 1 ↑.
Line 111 — 3 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 2 ↑, 1 ↓, 2 ↑, 3 ↓, 1 ↑, 5 ↓, 1 ↑, 1 ↓, 1 ↑, 1 ↓, 1 ↑, 4 ↓, 21 ↑.
Line 112 — 1 ↑, by Grahame Fairhill, 21 ↑.
Line 113 — 1 ↑, ⊓, SWAGMAN, 1 ↑,), GUARD, 1 ↑, 1 ⊢, WITH KEY, 10 ↑, % WITH GOLD, 1 ↑, .. DOG, 21 ↑.
Line 114, — 1 ↑, 1 ⊣, KEYHOLE, 1 ⊢, KEY, 2 ↑, (, SAFE ZONE, 10 ↑, $ SAFE GOLD, 1 ↑, ", GOLD 21 ↑.
Line 115 — 1 ↑, 1 GET KEY, 9 ↑, 2 OPEN LOCK, 9 ↑, 3 TAKE GOLD, 9 ↑, 4 GOTO ZONE, 8 ↑.
Line 116 — 25 ↑, please wait, 24 ↑.

EDITORIAL

BIG IS BEAUTIFUL. But only if big can be made small enough to fit on a single chip. Imagine a map of a major city such as London, Cardiff or Glasgow. You can see the fine details of roads and backstreets, the collapsing Victorian sewers, and even the power and telephone cables.

Now reduce that street plan to a quarter of an inch square and capture it in silicon. That is the kind of power-packing the chips of the future will offer as standard. The Inmos Transputer, Britain's contender in the superchip stakes, can already match 100 home computers for power.

So the important news for the mid-eighties may not be that IBM is starting to produce small computers — see this and last month's PCjr stories — but rather that big computers are being put on little chips.

IBM is know to be working on a 370 on a chip — a 370 is the mainframe that every big business had to have to keep up with the Dow Jones's. The computer that holds the equivalent place in the super-mini league is the DEC Vax. A project to produce this machine in chip form is also under way.

As the development work that put corporation computing power into an office micro is now computer fact — Hewlett-Packard's 9000 desk-top mainframe has been in existence for well over a year now — the time may not be far off when that sort of sophistication is available to the household user.

Down at the home computer end they are already making things smaller. The great advantage of the Vic-20 was that it cut down its component count by combining all the separate video functions on one chip. Now the Commodore 444 goes one step further. The Triple Four's Ted microprocessor deals with sound and system control, as well as video. Atari has taken similar measures to ensure that the 800XL has far fewer parts than its precursor the 800 — fewer components mean lower production costs which in turn permit larger profit margins.

By the end of the decade you will be able to slip into your pocket the kind of machine that in 1960 would have been controlling the entire United States early warning system — but what could you use it for?

The problem with having that magnitude of power is that the software you need to make use of it has to be as advanced as the chip's technology itself — otherwise you would be better off sticking with 6502s or Z-80s. The catch about making programs which are worthy of the hardware is that software development is already the major cost in creating a new system.

Consider the man-hours spent in developing the software for a low-cost home computer like the Spectrum. Sinclair Research could never have financed that operation alone. It needed hundreds of small software houses to turn the Spectrum into the best-selling machine.

If we are to have pocket-sized mainframes we should remember that NASA's Nastran program which helped design the space shuttle took a team of the world's top programmers 13 years to complete.

So even if you could have the super system now, you might be unlucky enough to have to wait 13 years for the software. At that rate most home users would rather settle for something a little more modest — possibly a souped-up version of the Z-80 which ran at 100 times its current speed.

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

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Barry Norman's Chip Shop

BARRY NORMAN is hoping that his new radio show, The Chip Shop, will do for computing what Film 73/74/75 and so on did for cinema. The show, which will go out on Saturday afternoons and Tuesday nights on Radio 4 will be a magazine of news and features on all aspects of computing. There will also be broadcasts of computer programs but these will be in the middle of the night to avoid making too many people turn off. You can catch the first Chip Shop at 5pm on Saturday, January 14.



Would you buy a second hand Spectrum from this man? Most of his music may sound second-hand but the cassette version of his "The Bop won't Stop" album carries Shakin' Stevens first ever piece of experimental music. The track entitled the Shaky Game will be familiar to any Spectrum owner who has forgotten to plug a lead into the monitor socket when loading a program from cassette. If you load it instead of listening to it you will find a game where you have to drive Shaky to his "Ole House" while avoiding clusters of lethal vampire bats. Where does he get his imagination?

Thumbs up from Sanyo and Sony for standard for all seasons

JUST AS THE FUTURE of MSX seemed assured by the release of the new MSX machines by most of the Japanese manufacturers a question mark is hanging over the compatibility of the first MSX machine to arrive in Britain. Sony, Hitachi, Sanyo and all the household names have shown new machines in Japan which all have different features but will still be able to run most of the same software, however their cartridge ports are a different shape from the one on the Spectravideo which claims to be the first MSX-compatible software standard computer to arrive in Britain. The chip set and Basic in the Spectravideo should allow it to run the same programs as the Japanese machines but it seems unlikely that cartridges will be interchangeable which was one of the aims of the MSX program.

Many of the Japanese computers have been designed to hook up to video recorders, video cameras, radio hi-fi and even robot arms. Although the chip set of a Z-80, Texas 9188 graphics chip, and AY-3-8910 sound generator, which is built in to all the MSX machines has been attacked for being too limiting it does provide 16 colours, and 32 sprites even if the resolution is rather low. But the Japanese have used these facilities in different ways while preserving compatibility for most programs.



SV-328, big brother to the Spectravideo we reviewed in November.

Hitachi's H1 is a portable with a real keyboard whereas Mitsubishi has gone for a desk top machine called the ML-8000 with a cursor control pad. Both these are 32K RAM computers while the Sony is more downmarket with 16K and a typically Sony catchy Walkman-style name "The HitBit". They all cost around £160 in Japan but will probably be over £200 when and if any of them are released in Britain. Toshiba has two models of its Pasopia the 16K HX 10S and 64K HX 10D. Interestingly the 64K version only costs £30 more than the 16K. The most exciting MSX machines from Japan are the Sanyo MPC range which build in additional hardware.

They are all equipped with built-in light pens and the top of the range MPC-X has a massive 80K of dedicated video RAM which allows it to manipulate its 512×204 resolution in new ways. The X can freeze a frame from a TV or video and display it on screen and then use it as raw material for computer graphics.

Meanwhile CK Computers is introducing the SV-328 which is the big brother to the Spectravideo SV-318 we reviewed in November. Although the professional keyboard including function keys and numeric key pad makes it look totally different the SV-328 is almost identical to the 318 except for its 80K RAM which includes 16K dedicated video RAM.

Oric should be driveless no longer. The ITL Byte Drive offers a 3in. 440K disc drive, below, for the Oric for around £300 while Oric itself is finally expected to release its own 3in. drives later this month.



Sinclair wants to build BBC while ITV plans own brand

WHILE RUMOURS persist that independent television is planning an ITV Micro to rival the BBC Micro Sinclair is trying to wrestle the BBC contract from Acorn. Sinclair has long claimed that Acorn should not have won the BBC contract because their design could not be built for the £200 the BBC had specified. In fact the BBC Micro was only on sale for a few months before the price went up from £200 to £300, and now the cheapest BBC you can buy costs £400 while Sinclair's contender which eventually became the Spectrum now costs less than £100. The BBC contract comes up for renewal in the Summer and Sinclair is as keen to take it as Acorn is to hang on to it. Lately the company has been making maximum possible use of the BBC's name — recent models of the BBC Micro have had the words British Broadcasting Corporation Microcomputer System spelt out.

YOUR COMPUTER TOP 20

Game	Company	Machine
Bugaboo	Quicksilva	Spectrum
3 Games for Children	Kindersoft	CBM 64
Defence	Microdeal	Dragon
Hang Glider	S. Electronics	ZX81
Jet Pac	Ultimate	Vic-20
Jungle Trouble	Durrell	Spectrum
Killer Gorilla	Program Power	BBC
Krazy Kong	Interceptor Micros	Vic-20
Lunar Jet Man	Ultimate	Spectrum
Maze Death Race	PSS	ZX81
Meta-galactic Llamas	Llamasoft	Vic-20
Screen City	Interceptor Micros	CBM 64
Sea War	Panda	ZX81
Starship Commander	Acornsoft	BBC
Super Gridder	Terminal Software	CBM 64
The Fast One	Campbell Systems	ZX81
The King	Microdeal	Dragon
Trench	Virgin	BBC
Ultrapede	Softek	Dragon
Zip Zap	Imagine	Spectrum

All the fours — new micro of Commodore's

COMMODORE IS finally abandonning the Vic-20 style plastic box for its next home computer, the Commodore 444. The Triple Four which will be launched at the Chicago Consumer Electronics Show in January will do everything the CBM 64 will do and a bit more but will user fewer chips to do it. Commodore specialises in keeping the number of components down. The Vic-20 was named after its VIC chip which combined all the video functions on one slice of silicon. Commodore manged to reduce the number of chips yet again when the 64 was built and for the 444 all the video, sound and control functions are combined on one TED chip. The Triple Four will have a built-in word processor, cursor control pads and a central processor based on an updated 6502. The 444 looks like something out of the Starship Enterprise — a wide version of an Atari 400 but with sculpted keys. It could be late next year before the 444 arrives in Britain.

His master's voice box

"LEFT A BIT, left a bit, up, Fire!" It would be much more fun to shout instructions to the computer than to use a joystick or keyboard. You can of course write your own program which with the aid of a microphone will allow your Micro Command, a new speech recognition unit for the Spectrum will allow you to do this much more effectively. You have to train the Micro Command to accept various phrases in the voice of whoever is going to use it. It will not work with existing commercial software unless you can break in and scan for key inputs but a game called "Sheeptalk" comes with the unit. The only other disadvantages are the price, £50, and the time taken to translate spoken commands which makes it unsuitable for high speed arcade games.

Cabbage patch kids lead by a head from IBMjr and Mackintosh.





Left: Coleco Adam and right IBM PCjr.

Cabbage patch kid maker Coleco's Adam looks as if it is going to beat Apple and IBM's little piggies to market. All three are taking different approaches as they try to persuade people to park with as much as £1,000 for the computers they have always dreamed of.

IBM's PC jr — which is a stripped down version of the £3,000 PC — will cost around £600 when it arrives here towards the end of 1984, but the model with a built-in disc drive will cost over £1,000.

The Adam on the other hand will be available in the spring at around £700 including daisywheel printer and high speed cassette drives.

While the IBM stresses upwards compatibility and the Coleco offers value for money, Apple has some new tricks up its sleeve with the secret Mackintosh project which shuld be unveiled this month. Details are scarce but insiders expect a small version of the Lisa.

Learn to read with your Spectrum and old PM

SIR CLIVE believes that home computers are going to be very important in education because they can offer "infinite patience and infinite attention." Now Sinclair is showing how serious he is by releasing 16 educational programs for the Spectrum covering everything from learning to read to elementary science.

The "Learn to Read" series is being published with Macmillan and so ex-Prime Minister Harold Macmillan was wheeled out to give his blessing to the project: "I am pleased that in my 90th year my family business continues this worthy tradition by joining Sir Clive Sinclair in this great technological advance." It certainly is an advance compared to the late '50s and early '60s when Macmillan was PM — a machine with the processing power of the Spectrum would have filled a room and cost over £100,000. The five "Learn to Read" programs are not cheap — £9.95 each — so it will cost nearly £50 to take a child from recognising letters to composing simple sentences.

Sinclair is also selling six new spelling and education programs from Blackboard Software as well as four Science Horizons cassettes from Macmillan again. These science programs are designed to give 8-12 year olds simulations which will be fun, based on gliding or survival games for instance but which at the same time will convey some scientific concepts. Perhaps the most interesting of all these programs however is MicroProlog. Prolog is a language much favoured in artificial intelligence circles and which has been chosen to be used on the advanced Japanese Fifth Generation computer project. The Sinclair version is necessarily not as powerful but it gives an introduction to a new way of working with the computer. There is even a sample program called Simple which should make it easier to understand the language quickly.

Swiss Canton's crack-down on the video-game nasties

IT IS 1984 — Big Brother steps in and bans all video games to protect morality. Science fiction! Not in the Swiss canton of St Gallen where the government has spent the last year removing video games and pinball machines from bars and arcades. The 390,000 inhabitants of St Gallen voted in 1982 to ban the machines but gave one year to allow restaurant and bar owners to remove them from their premises. This period ended on October 31 1983 and so the ban started on November 1. Electronic games were thought to encourage "violence and aggression in which people or animals have to be destroyed."

If you must let a bunch of academics from Bangor loose on a micro don't be surprised if they call the set of history and English revision programs for the Spectrum, Academias. This is the catchy title Sussex Software is using for its question and answer tapes.



Maybe you should be glad that you are still waiting for your Electron. Acorn's marriage guidance programs for the Electron and BBC Micro "I Do" and "The Dating Game" seen in action below do not seem to be having quite the desired effect.



While Shaky's shaking Dave Lee Travis is aching to see someone solve the £10,000 computer puzzle challenge he has set up with Twig Systems Software. He is pictured at the controls of a BBC — very suitable — with The Tower one of six programs in his Monster Micro Challenge. Solve all six programs, a mixture of adventures, quizzes and arcade games and you could be in line for the grand final where the first ten people to send in correct entries will battle it out for the £10,000 first prize.



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I could do that...

Your micro, like every computer, appears to be doing several things at once — for instance, have you ever wondered how it manages to keep its real time clock going, and the TV screen refreshed, and keep an eye on that 'Break' key, all while running your various program?

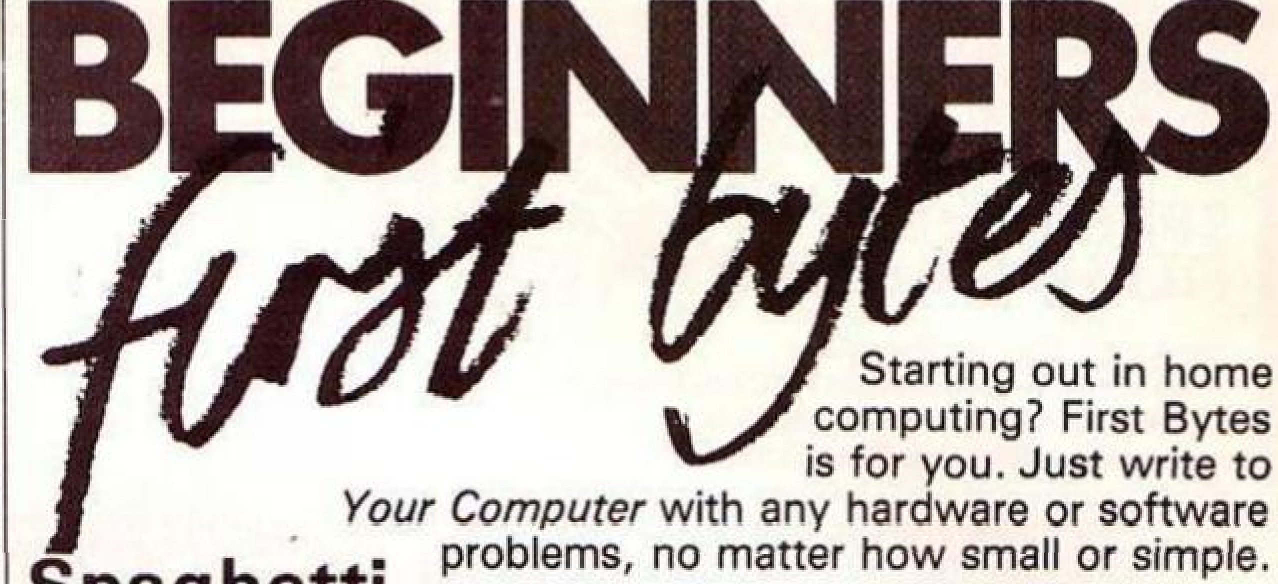
It is all done with interrupts — signals to the CPU or central processing unit, that it should stop what it is doing, remember the next instruction to obey, when it can get back to its place again, and transfer control to whatever caused the interruption. Of course, some interrupts are more important than others, so most micros employ a daisy chain effect — the priority of an interrupt is dictated by its position in the chain.

So this month's problem: we want a program which will display on a screen the message "Break", "Screen", or "Clock" for a few seconds whenever one of the B, S or C key respectively is pressed. Remember that if, for instance, the S key is pressed it must interrupt Break instantly, but it will not interrupt "Clock"; it must be processed though, after the "Clock" cycle is complete.

The winner of November's competition to design a clock for your microcomputer — without cheating by accessing the machine's own internal clock was Simon C Wood, whose program for a ZX Spectrum was as follows:

```
10 LET t=0:LET v=0
20 FOR x=1 to 211
30 NEXT x
40 IF v=1 THEN LET v=0:GO TO 60
50 LET v=1
60 LET t=t+1
70 PRINT AT 10,14;t
80 BORDER v*7
90 GO TO 20
```





BEGINNERS first bytes

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

Spaghetti programs

THE MAJORITY of microcomputers available on today's market come readily equipped with the Basic programming language. If not, they carry the facility to load Basic from either — cassette — Sharp MZ-80K — or cartridge — Atari 400.

Basic, like other high level languages is an interpretative language. This means that it allows the user to key in words and symbols that the computer does not really understand but which are run through the interpreter and are turned out as machine-code. It is due to the fact that the Basic interpreter is a lengthly program itself, that Basic is slow. But Basic does have its advantages in that it is easy to learn, easy to program and teaches you about computers.

For a Basic program to be exciting and challenging enough to justify all of the work you have put into it you must learn to write compact, swifter Basic.

Gosubs and Gotos in the program are a place where speed can really be lost or gained. When the Basic interpreter comes across a Goto/Gosub statement it does two things.



First, it finds the location to where it must jump and second it checks its own program counter — the current line number — and subtracts it from the new location. If the answer is positive, the search for the new location starts at the present location, if the answer is negative the search begins at the beginning of the program.

From this information we can deduce that in a program that refers to a certain subroutine time and again, that subroutine should be placed at the start of a program. In a fair-sized program — 6.5K — for a Vic-20 a program can take 10.5 milliseconds to find a subroutine at the end of the program, yet only 0.9 milliseconds to find a subroutine at the start of the program.

The entire principle of speeding up your Basic is to avoid scanning.

(continued on page 59)

Define a Modem

"What is a Modem and what is it used for?"

ALONG WITH MANY other terms making up the jargon of the computer industry, Modem is a combination of two words, MOdulator and DEModulator.

A Modem is an electronic unit which may be an external "black box" or an inbuilt part of your computer. Its main function is to form a connection or interface between the two worlds of Digital, as used by a computer and Analog, as used by communications links such as the public telephone system.

When digital information in the computer is to be carried by a non-digital type of system it must be converted into a form suitable for that system. For example telephone lines are designed to carry signals which are generated by the microphone in the telephone handset. These voice signals have a certain well-defined band of frequencies which the telephone lines and associated equipment are able to handle.

The function of the modulator section of the Modem is to convert the digital signals coming out of the computer, usually via a serial RS-232 port, into tones which the telephone line treats like voice signals. At the receiving end of the phone line the demodulator converts the tones back into data that the computer can read.

Usually data can flow in two directions at once by careful selection of the tones used. This simultaneous two-way type of operation is known as "full-duplex". A Modem which can only send data in one direction at a time is known as

(continued on page 59)

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★ **PRINT** on screen or ZX printer. Compatible with Kempston centronics interface for full-size printer, any line width. Can be combined with FIND, and can mix selected parts of records with text in any format.
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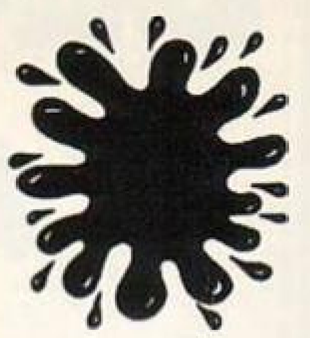
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Spaghetti programs

(continued from page 57)

Another time when Basic has to scan the program is when variables are called. All computers have a storage space for variables, in this store the computer places the variable names and their values on top of each other. When the program wants the value of a certain variable it begins searching through the list — from top to bottom. If the variable is some way down the list, the search can take quite a time. Arrays are stored separately, A (1) — × (1000) is stored as one variable.

There is no extra time taken to find a variable with a single letter name than that to find a variable with a multiple letter name. Remember though that the computer only takes the first two letters of a variable into account and that variable and vanity would in the computers eyes be seen as the same variable.

If your program contains constants of high values — such as 444.413 — the computer has to set space aside for it — seven bytes — and re-evaluate it every time it comes across it. If, at the start of a program, you placed the statement A=444.314 you would save six bytes and about 13 milliseconds every time this number is encountered.

Loops are a complex subject. When looping something you must remember to keep delays within the loop as small as possible, as each of these delays will be multiplied by the amount of times the loop is in progress.

To fully understand the concepts of "looping the loop", you must first understand the way the computer's stack works. The computer stack employs a principle commonly known as LIFO — last in, first out — and is sometimes known as a pushdown store. Stacks, as the name suggest, are a stack of values, the computer can only get to the first of these values and because these things are entered onto the top of the stack only the last entry is obtainable.



For every For-Next loop there are entries to the stack for, the For variable, the To value and the address of the start of the loop. Due to the LIFO principle of the stack if we have two loops, one inside the other, the first Next will be part of the last For-To loop:

```
10 FOR T = 1 TO 100
20 FOR M = 1 TO 10
30 NEXT M
40 NEXT T
```

The M and T after the Next statements are not necessary, but are there to show you the principles of LIFO. Try to arrange you loops so that the inner loops have the largest numbers as this makes the program faster:

```
10 FOR M = 1 TO 10
20 FOR T = 1 TO 1000
30 NEXT:NEXT
. . . 9.05 seconds
10 FOR M = 1 TO 1000
20 FOR T = 1 TO 10
30 NEXT:NEXT
. . . 13.24 seconds
```

The difference comes from that in the second program the For . . . Next statement is read and interpreted 1,000 times and not 10 times as in the first program.

Martin Dunn.

Graphics

"Everyone spends a lot of time talking about a micro's graphics capabilities without ever explaining what they mean. Could you explain it for me, and could you tell me how important it is?"

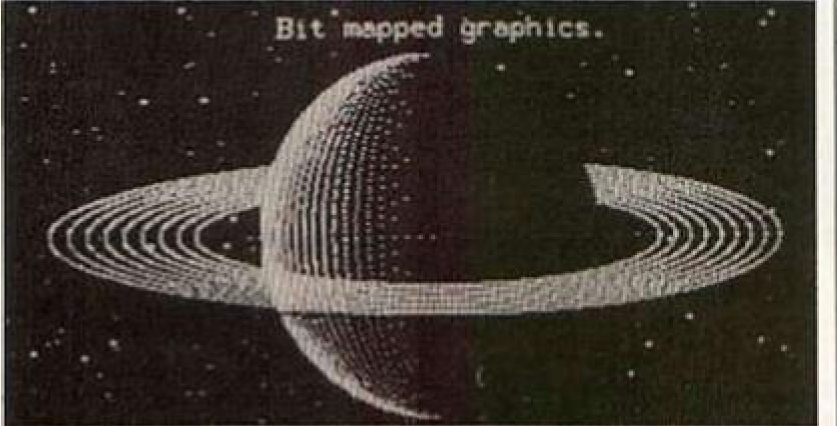
THE GRAPHICS capabilities of a micro is a relatively new field, since until a very short while ago, there were no graphics capabilities on micros.

Often, when people talk about the graphics capabilities, they actually mean the colour capabilities of the micros. Naturally this confuses. The two are linked, since quite often the number of colours available depends on the way that the graphics are being used.

The key to the graphics on a micro lies in the word "resolution". This means, literally, the number of dots on the screen that can be displayed. Each of these dots is the smallest part of the screen that can be addressed, or accessed. Or, to put it in plain terms, the smallest bit that you can draw on. The higher the resolution, the smaller the bit that you can address.

In some machines, the resolution can alter, for example on the BBC there are eight modes available, each of which gives a different number of pixels — picture elements or dots — and number of colours available on the screen.

The number of colours that you can have on the screen varies enormously, from machine to machine, from a minimum of two — that is black and white, green and white etc. — to 256. The Commodore 64 allows this many, but it is difficult to get more than a selection of these on the screen at the same time. The BBC allows eight, of which you can choose to have all eight, or you can for a different mode which allows you to select a few of the eight.



An important factor in choosing a machine on its graphics capabilities is undoubtedly the ease with which you can select the colours you want. This is a major problem with the Commodore, in that it is difficult, ie. you have to fiddle around with Peeks and Pokes to get the colours, and graphics, you want. On the BBC there are excellent graphics commands available from Basic, for drawing and plotting, and also for selecting what you want to do graphics-wise with any part of the screen.

A machine that has had a lot said about it lately is the Elan. This has a very high resolution — 256 by 625 pixels — and also allows you to have 256 different colours on the screen at a time. However the Elan is not available, and I shall believe it all when I see it.

There are several trick techniques that can be used to give you more colours than are supposedly available, for example the famed Dragon 32 colour mixing program which, by printing colours in alternate lines gives you a whole new range of colours. This technique can also be used to great effect on the Spectrum and the BBC.

The way that graphics are presented on the screen is usually by a combination of Draw commands to make shapes, and then Fill commands to colour these in. The state of the art at the moment means that mostly you have to write these commands for yourself, but some machines do make it easier for you than others, by having useful commands from Basic. These are usually of the Plot and Draw variety.

Another way of getting graphics onto your screen is by creating them beforehand, storing them in memory, and then transferring that part of memory to the screen. This can be done easily on most machines, and with the help of tools like pixel editors the pictures can be drawn relatively quickly. Once the picture is in memory this method is generally faster than the Draw Fill method.

All in all if you are going to buy a microcomputer for its graphics then it depends on how technical you want to go. If you want to be able to get straight down to it, and you do not mind the limitations of eight colours, then the BBC is a good bet. The Commodore 64 offers you more, but it is much harder to get at. This also applies to a certain extent to the Spectrum, which also has the problem of allowing you plenty of colours on the screen, but only a limited number within any given character.

Piers Letcher.

Modems

(continued from page 57)

"half-duplex".

The speed of transmission of the data is measured by the number of bits per second, commonly called the baud rate. There is a relationship between the baud rate and the range of frequencies used to send the data. The higher the speed the wider the frequency band used. On a normal telephone line a typical maximum data rate usable is 1200 baud.

A higher quality line is able to operate at a higher speed but the Modem design is more complex and thus more expensive. The speed does not have to be the same for the transmit and receive directions. A Prestel modem for example receives data at 1200 baud but transmits back to Prestel at 75 baud. Other common Modems send and receive at 300 baud.

Connecting a Modem to your computer gives you access to a vast range of services and facilities. For example there is the Prestel system which is a very large database containing over 250,000 pages of information. Some sections contain information of particular interest to home computer users, including "Telesoftware" which can be downloaded into your machine. Other types of services accessable via a Modem include bulletin boards where you can post messages to other people to read.

It is also possible to use your computer as a terminal on a remote mainframe computer such as those available at universities and colleges. There is a large and growing range of services available once you are able to connect to external computers. A Modem could be the most important peripheral that you buy for your personal micro.

David Simpson.

If you have anything of interest to tell us about your computer club why not contact us on 01-661 3144.

Local news

Nottingham

The BBC Micro user group is a newly-formed sub-group of the well-established Nottingham Microcomputer Club and meets on a monthly basis in the centre of the city. Beginners and professionals alike are welcome. As well as providing a focal point in Nottingham for information about the computer, its hardware, software and sources of supply, the group intends to bring together like-minded users — radio hams, educationists, games players, businessmen and so on. Contact John Day on 0602 225660.

Marston

In an otherwise peaceful part of rural Oxfordshire, some fanatical hardcore computerniks have formed a group called the Marston Computer Club. They are all 15 or 16 years old. Most are regular *Your Computer* readers. They boast openly of their addiction to computer games. Jeff Minter has even written an article for their monthly magazine *Newline*. They pursue their decadent life-style once a month, playing the latest games on Spectrums, Vic-20s and CBM-64s. If you really want to get involved in this sort of thing, there is probably no sane, reasoned argument that would stop you. Write to the self-styled president — sometimes known as "the Chairman" — Chris Brunsdon at 12 Park Way, Old Marston, Oxford.

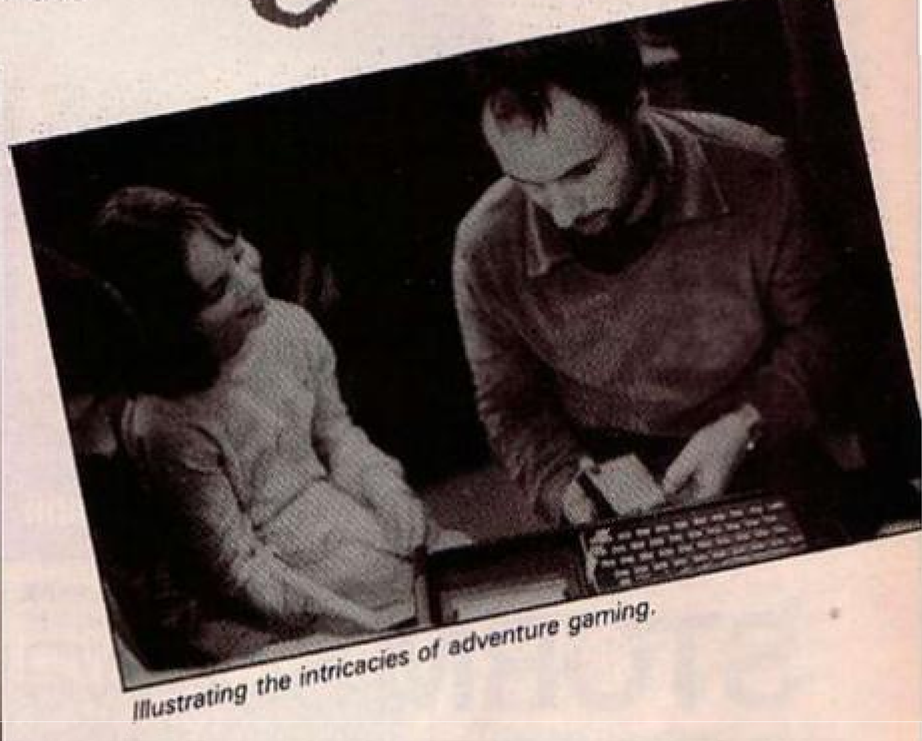
Holt

Holt Village Hall near Trowbridge, Wiltshire is the venue for North Wiltshire Computer Club..On the second and fourth Wednesday of each month a varied membership owning everything from ZX-81s to Apples gets together. Contact the acting secretary, c/o Holt Village Hall, near Trowbridge, Wiltshire. Telephone 0225 782808.

COMPUTER club

AYLESBURY

Paul Bond goes in search of adventure and finds it in Aylesbury. He discovers what makes a good adventure game and has his palm read by a micro with its eye on the future.


Illustrating the intricacies of adventure gaming.

AYLESBURY LAST GOT a visit from *Your Computer* magazine in the high summer of 1982 — May, to be precise — when our news pages carried word of the impending release of the fabled Sinclair ZX-82 and Aylesbury ZX Computer Club, as it was then known, was concentrating on ZX-81 graphics.

Great changes have been wrought in the world of microcomputing since then and, in acknowledgement of this fact, the club has cast its net wider and dropped the ZX from its name. As the main microcomputer club in the area, the Aylesbury group found that, despite the fact that it was primarily a Sinclair user group, other users were inevitably drawn to the club.

Weekly meetings are held each week at Quarrendon School each Friday at 7.30pm and monthly meetings at the Mandeville centre in Aylesbury.

The club is a veritable hotbed of writing activity: members include club secretary David Nowotnik — Nowotnik of the puzzle — and Barry Cornhill — of the Black Planet. Several members have had software accepted commercially. One interesting Spectrum application developed by club member David Larne was a program to work out the mathematical calculations necessary for effective colour photographic development.

The computer can be used in the dark room, if a printer rather than a vdu is used to monitor the output. The program does things like work out exposure values, and timing routines for each step in processing. He has only sold about eight or 10, although a fair amount of interest was generated by his contribution to May 1983's *Amateur Photographer* magazine feature on home computers and photography. Superstition triumphs over rationality it would appear even in the world of computers, for his astrological program which calculates ephemerises has been somewhat luckier.

The club can trace its roots from August 1981 when Aylesbury's "gang of four" started meeting to talk about their Sinclairs. By January 1982 the club had 30 members.

"Only about three percent of members are interested in learning about programming," commented a committee member. "You can see that here we're dealing with two basic age groups — about nine years old and 45 years old."

The club arranges stands at all the major computer shows, usually the province of Bryan Judson.

"Manning the stand is not an easy number," he maintains. "You earn your free entrance." The club indulges in a certain amount of evangelising, organising and participating in functions at local schools, and is currently pursuing a plan for more active participation with the local education authority in computer-related learning courses.

The club has a basic software library consisting of over 100 items many of which club members were actively engaged in making safety back-up copies of. Barry Cornhill was busy testing out his new adventure Moons of Tantalus and explaining development techniques.

Another well-known adventure game creator, Richard Shepherd, was present on the evening of *Your Computer's* visit to take part in an informal question and answer session. He revealed that his company, Richard Shepherd Software, had been running for about two years, but really only came to the boil in February 1983. The company now employs about six people plus hangers-on. They specialise in adventure games software.

Until recently he wrote all the ideas himself. Asked what he felt the criterion of a good adventure to be he replied that it should be something unusual and interesting, a break from the common mould of dungeons and dragons with a dash of humour. Market intelligence for RSS apparently consists of reading every single home computer magazine — employees are apparently manacled to their desks until they can give a satisfactory verbal digest of the week's news.

What *is* going on then? queried a member appositely. The biggest change in the market as far as RSS was concerned was the way in which mail order had dropped off and chain stores had taken over as outlets. He did not see much future for the Microdrive until a suitable duplication facility for the cartridges had been developed. Basically companies like RSS are waiting for Sinclair to get his act together.

For more details about Aylesbury Computer Club, contact Dr David Nowotnik on Aylesbury 630867.

Brainstorm!

Widely used in schools

4–8 year olds

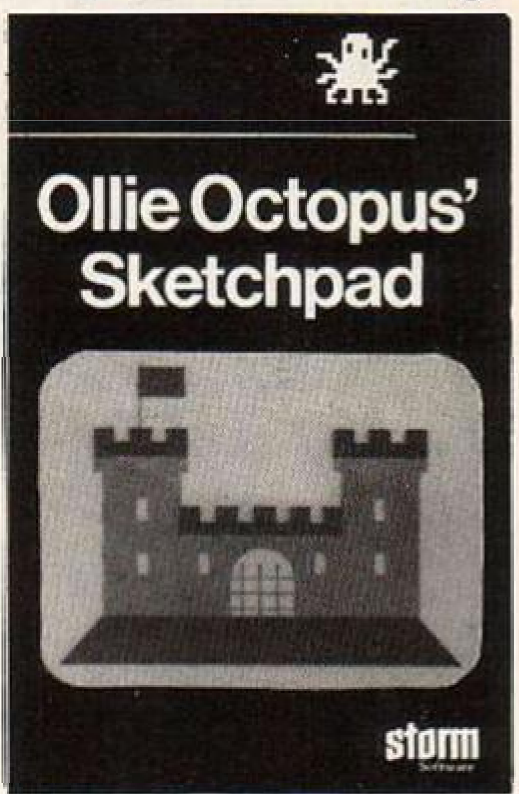
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SOFTWARE Shortlist

Star★chart

Everest Ascent
CBM-64:
Adventure:
Richard Shepherd Software:
£6.50:



A new implementation of the mountain-climbing game for the CBM-64. Given £1,000 you must hire sherpas and purchase equipment for the climb. You get a quick graphic to tell you whether it is day or night on the mountain, but most of the time, this is a text adventure game. I cannot honestly say that this game fired my imagination very much — it does not seem to differ very much from the Vic-20 version, but I only played it because it was there.

Gridrunner
16K/48K Spectrum:
Shoot-'em-up:
Quicksilva:
£6.95:

★★★★

By putting the Spectrum's sound output through the speaker of your cassette player, you can put back into Gridrunner what the weedy sound facility of the Spectrum removes, the zap of plasma cannons, the dull crump of exploding pods. Obviously the reason that in space no-one can hear you scream is that there is such an almighty racket going on anyway; it is only a matter of time before the neighbours come round to complain. A splendid implementation by Jeff Minter for the Spectrum of his original game.

Flight 015
Vic-20 unexpanded:
Simulation:
NKK Software:
£5.95:



Noised abroad as the only flight simulator for an unexpanded Vic-20, one is tempted to say "I can see why". Written by record producer John Wagstaff, apparently better known in West Germany as pop star Lee Kristofeson, a brave effort is made, given the limitations of the machine, to simulate the rudimentary requirements of any self-respecting flight-deck.

Shark Treasure
■*Dragon 32*
■*£12.95*
■*Dragondata*



ONE OF THE best games, graphically speaking, that we have yet seen for the Dragon. The idea and the action are very simple. You, as a deep-sea diver equipped with three flash grenades have to progress from the surface down to the seabed and pick up three of the valuable items lying on the sea-floor, then return. The catch? a couple of shoals of very nasty man-eating blue sharks, which increase in number and ferocity as your swimming skills develop. The stun grenades reverse the direction of motion of the sharks but you cannot kill them.

True, the game is basically Frogger with a few frills, but the way that the sharks speed up towards the small figure of the diver as their jaws snap open is truly horrible. You do not have to study psychology to know we all have a deep-seated fear of being eaten alive.

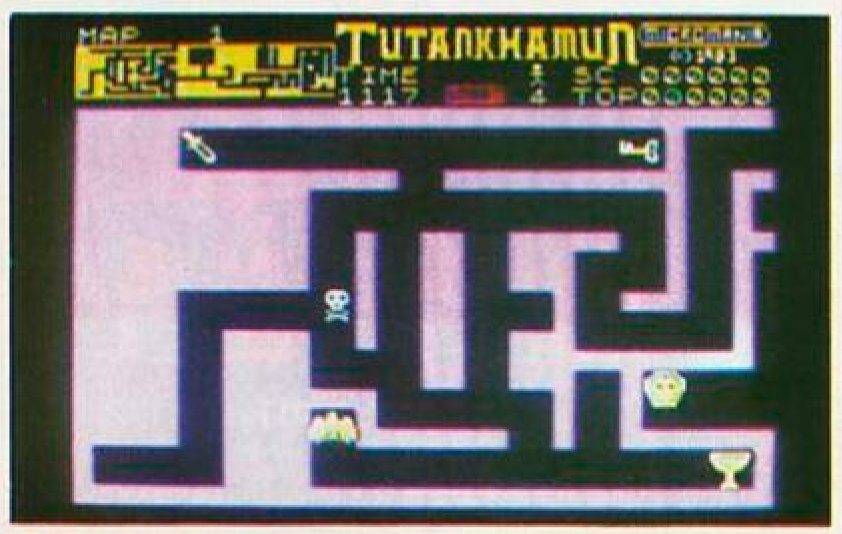
On the minus side, once you attain the level where there are three streams of sharks between you and the gold, and once you have got the knack of not becoming fish-food, there is no real progression in the game. Also there is a strange is-it-a-bug-or-is-it-a-feature dilemma: sometimes when you use the flash grenades, half your mangled body is left floating in the depths, only to be scooped by by another passing shark.

Everybody remembers that scene in *Jaws* where the diver swims into the bottom of the wrecked boat and the gruesome cadaver sinks towards him. If you do not, you probably blotted it out of your memory, it was so horrible.

This, then, is a game that you will find gripping at first, but may tire of. But the smooth sprite-like motion of the sharks will get you pondering about how they did it.

Tutankhamun
■*48K Spectrum*
■*£5.95*
■*Micromania*





YOU CAN HAVE the tomb of your life with this colourful machine-code maze game. In fact you can choose from five tombs of varying difficulty in which to play the role of an armed explorer who is endeavouring to collect the priceless treasures placed in the great Pharaoh's massive sepulchre.

The explorer is moved around by means of a Kempston or AGF joystick or by the familiar A and Z to go up and down, M and N to go right and left. The remaining keys on the bottom row fire the lasers, and there is a smart bomb facility which can only be brought into play once in every tomb or life but it kills everything on the screen except you.

Points are scored by collecting the treasures and shooting the creatures. Bonus points are awarded for especially quick completion of a tomb. The screen scrolls to the left though if you wish, for some obscure reason, to retrace your tracks it will scroll to the right.

Every tomb has between one and

(continued on page 65)

Gangsters
■*48K Spectrum*
■*£5.95*
■*Strategy Games*



JANUARY 1920. This is Spectral City — your city. And you are a leading mobster in the days of American Prohibition, when the government made drinking alcoholic liquor illegal. You mean to take over the city from the other gang leaders and control it.

The relative strengths of the rival gangs of hoodlums are first presented on the screen in the form of a grid. You can see how many distilleries, speakeasies and houses of ill repute the opposition have in their grip of vice. Next is raised the "thorny question of bribes". You must figure out how much a month you can afford to keep the precinct sweet. This is certainly worth doing as the police raid your distilleries with monotonous regularity.

There is an alternative: you can shop your rivals, but presumably due to their own activities in the area of palm-greasing, they are sometimes found innocent — then they get real mad with you.

The distillery raids are graphically displayed on the Spectrum by three police cars rolling up to your warehouse door sirens and all. When I raided an opponent's brothel — this is done by moving a gunsight over a schematic map of the city and pressing S when you want to move in — I discovered an arms cache. This boosted my gang's morale and another graphic showing the doors opening and the guns inside was displayed. Gang morale is key: it starts at 20, but changes depending upon the success.

SPOT THE DIFFERENCE!

Choosing which game to buy from the mountain available is a difficult job, especially when everyone claims to produce the best on the market. But how can you tell the best from the rest?. To help you decide, read on. . . .



THE DUNGEON MASTER

Let your Spectrum be your guide in a totally new dimension in adventures in the true spirit of traditional role playing games where YOU design the scenario.
"I have been a Dungeons and Dragons fan for several years...The package provides excellent entertainment for all fans of the cults and should prove a good introduction to the game".
...Sinclair User.
"Highly recommended for its versality, originality and quality. Definately well worth obtaining".
...ZX Computing.

ZX Spectrum 48K £7.50
Written by Graham Stafford.

What the real critics say. . . .

Very rarely have software titles produced such universal acclaim as 'Halls of the Things' and 'The Dungeon Master'. Now, with three brand new programs, Crystal continues to set the standard of software excellence. The difference is obvious - the choice is yours:

The Best or The Rest.

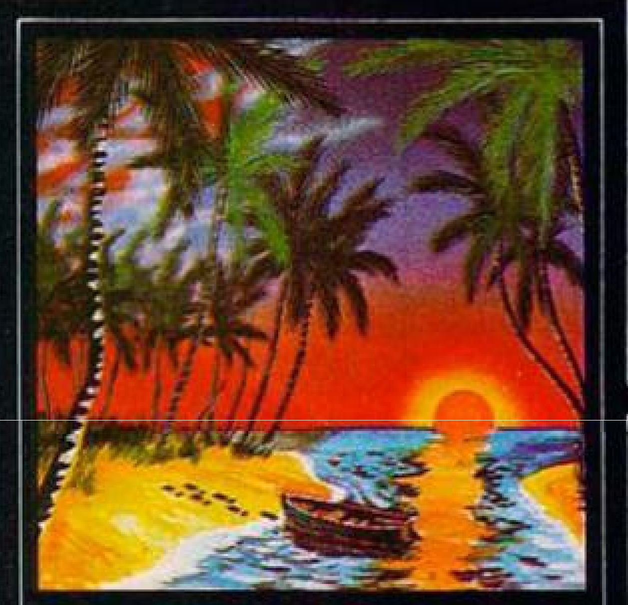


HALLS OF THE THINGS

A stunning multi-level maze 'arcade adventure'.
"Excellent and dangerously addictive - could change the Spectrum games scene overnight".
...Sinclair User.

"Spectacular - One of the best games I've seen, finely balanced between simplicity and addictiveness - superb graphics and colour - I CAN'T RECOMMEND IT HIGHLY ENOUGH".
...Popular Computing Weekly.

ZX Spectrum 48K £7.50
Written by Neil Mottershead, Simon Brattel and Martin Horsley.



THE ISLAND

The ultimate test of logic and deduction! Can you solve the hidden mysteries of the South Pacific Island on which you have been stranded - and escape alive! A brilliant classic style adventure game to facinate and frustrate you for months!

ZX Spectrum 48K £7.50
Written by Martin H. Smith.



INVASION OF THE BODY SNATCHAS!

At last! a version as fast and furious and as frustratingly addictive as the arcade original. Landers, Mutants, Bombers, Pods, Swarmers and much much more combine to produce the ultimate space game!

ZX Spectrum 48K £6.50
Written by Simon Brattel and Neil Mottershead.



ROMMEL'S REVENGE

A brilliant interpretation of the most visually stunning arcade game of all time. Superb high resolution 3D graphics with full perspective plus a host of new and exciting features make Rommel's Revenge the most spectacular game ever produced for your Spectrum!

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Star chart

Laser Snaker

48K Spectrum:
Shoot-'em-up:
Poppy Soft:
£5.95:



Basically a centipede style game. There is a chance to win £100 once you penetrate the myriad mazes of propagation and discover the secret symbol. You have to be able to answer two questions

what kind of snake are you and what was the thing you saw? You steer using the cursor keys or a joystick and fire using the zero key. The laser defends you against vicious green Aggronoids and the poisonous blue Viproid, which tries to steal the eggs. There are also death chrystoids lying around. Excellent use of colour and tough at all levels.

Crazy Caveman

CBM-64:
Novelty:
Merlin Software:
£6.50:



Crazy Caveman is, as the name suggests, about a little prehistoric man who leads a somewhat monotonous life of jumping over rolling rocks and hacking down identical dinosaurs with single blows of his axe.

Playing this game, although only slightly more exciting than washing-up, is in fact, quite addictive and I soon found myself proficient enough to meet bouncing dodos and birds that bombed me with rocks.

I'm in shock

16K Spectrum:
Shoot-'em-up:
Artic:
£4.95:



"The moon was the colour of wide frozen shrieks of laughter, the frost line ran down the window . . . I'm in shock". So goes the blurb for this engrossing grid game. You are zipping around the bottom of the screen as per Gridrunner, but without the peripatetic plasma cannons. Instead fiendish diagonal step deflectors are laid across the screen, so you cannot shoot straight up at the invaders, but have to allow for deflection.

(continued from page 63)

four doors which must be unlocked with the keys that are found in the tomb. Each key can only be used once and you cannot carry a bunch of them about with you. Your laser only works when firing to left or right.

SOFTWARE *Shortlist*

Ultisynth

■ *CBM-64*
■ *£14.95*
■ *Quicksilva*



ULTISYNTH 64 IS A program by Nalin Sharma, well-known to *Your Computer* readers for his delightful Scram-20 game for the Vic-20 in June 1983 issue. He has written a program which is intended to make full use of the CBM-64's Sound Interface Device chip. The SID is one of the better sound chips around and the idea behind this program is to fully utilise all the features of this chip as well as introducing many of the features of commercial synthesisers.

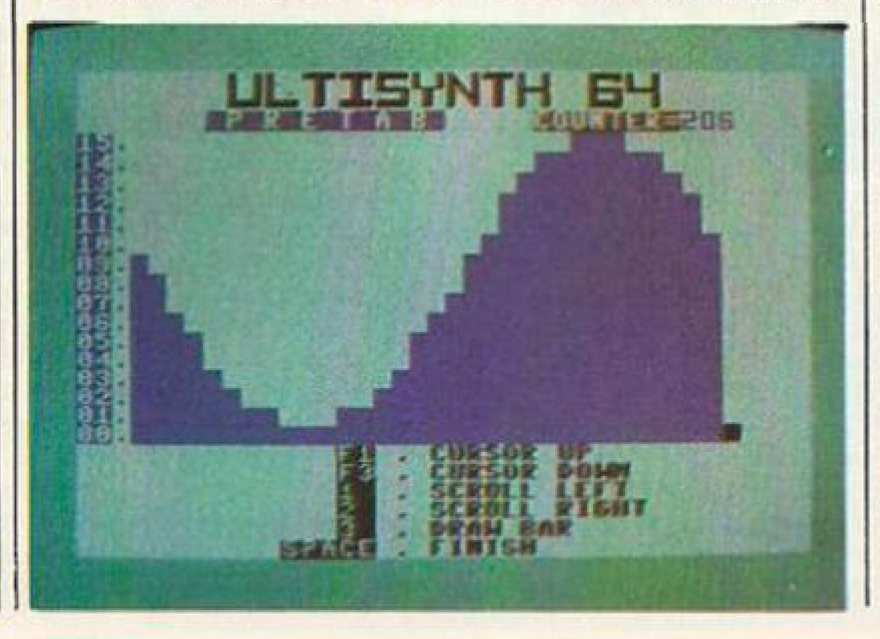
The Ultisynth is pretty daunting at first sight. For a start, it redefines the keyboard in four different ways: you can use the keys on their own, or together with the Shift key, or together with the Ctrl or Commodore key to achieve different functions from the same keyboard. There are seven options presented, record mode, playback mode, compose mode, load mode, save mode, transferring notes, rhythms/background music and a feature called Pretab that allows real-time control at any of 256 speeds of voice 1 frequency, filter cut-off frequency, pulse-width of voice 1 and filter resonance.

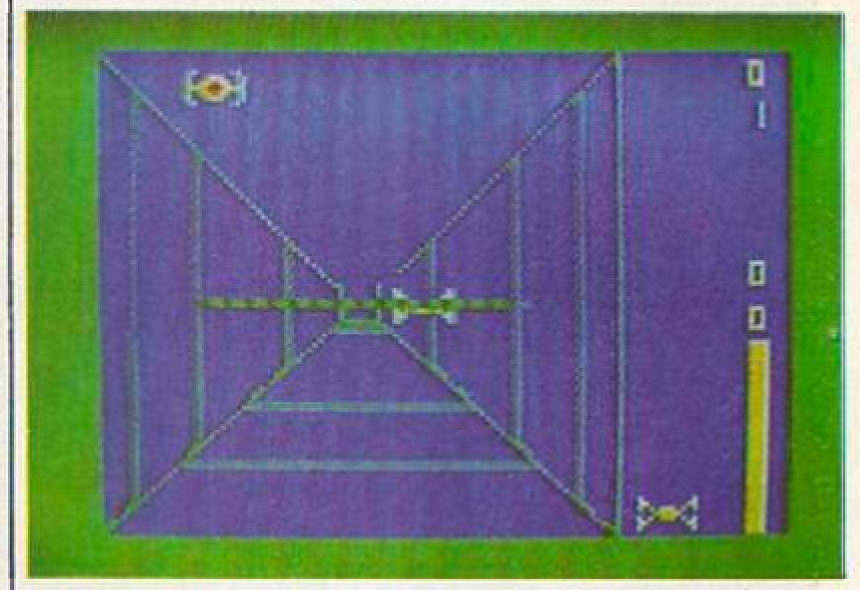
As you are probably beginning to realise, this program threatens to make a Fairlight music synthesiser look as easy to operate as an Indian nose-flute by comparison. The best way to hint at the options available is to describe the procedure necessary to synthesise the sound of, say, thunder.

First, you get into record mode. Next you deal with the envelopes which are divided into A, D, S, R — for attack, decay, sustain and release. These are controlled by the keys 8, 9, 0 and plus. The keys on their own that is, no Ctrl, shift, etc. The screen display in record mode shows you four columns headed A, D, S and R. Press 8 and you will see the numbers in column A Change. If you want the number to decrease you press Shift and 8. There is full wraparound and auto-repeat. Thus you select an attack of zero, a decay of zero, a sustain of 15, and a release of 14.

Now you put the filter for voice one on. This is done by pressing Ctrl and E. You will see a little dot appear under the column headed F. Now to select a waveform for this voice. This is done by pressing the minus key till four dots appear under the W column. Now for filter cut-off frequency. Press the Ctrl key plus Y to decrease, plus U to increase the number of blocks shown in the bar-graph. filter resonance is altered by Ctrl F and G in the same way. Filter type is chosen by Ctrl R and T. Now all you do is play the note A 4.

This practical description was the best way I could think of for hinting at the facilities available to you with this program, although anyone who tried Stephen Watson's CBM-64 Synth in September *Your Computer* will have had an inkling of the SID's wonderful capabilities.





Intergalactic Force

■ *Dragon 32*
■ *£7.95*
■ *Microdeal*

★ ★ ★

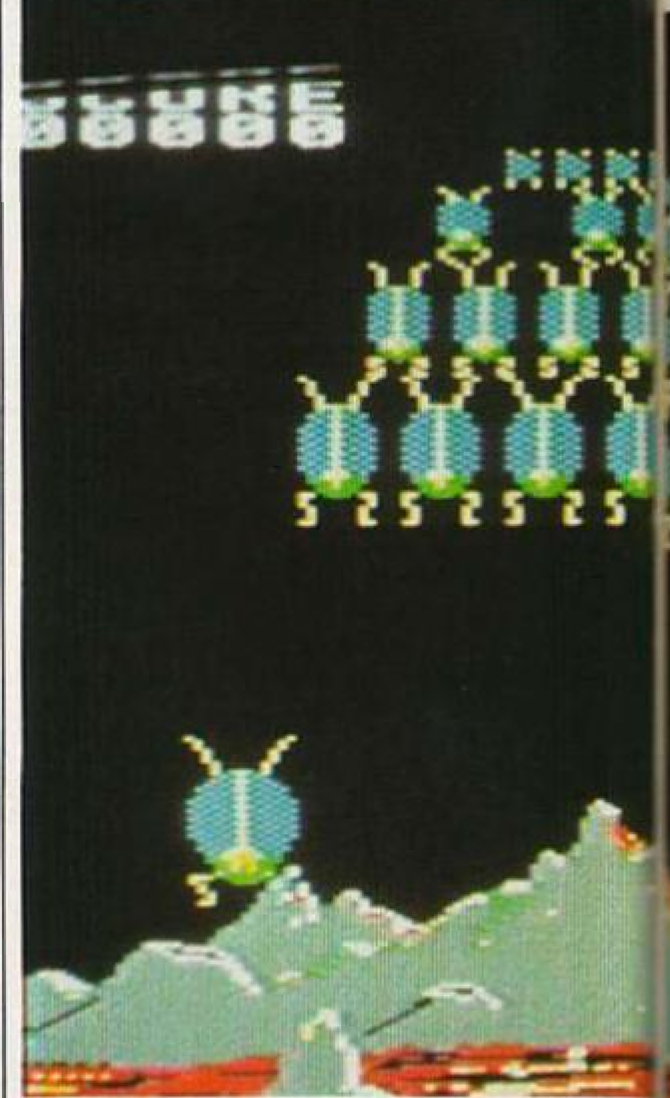
YOU FLY DOWN a corridor dropping bombs down ventilation shafts and dodging the Thi fighter which is trying to drop bombs on you. Almost a 3D game, this bodes well for the Dragon which people have taken to saying is a software-driven machine.

This means that if you take the trouble to get to know it, you can achieve great things. Most of the games which are graphically promising on the Dragon 32 tend to lack surprises or any capacity to develop beyond a certain stage. It is to be hoped that the Dragon's big brother with 64K RAM will provide the necessary extra room to create truly addictive games.

Having said all this, Intergalactic Force is a pleasant departure from all the tired green-looking games for the Dragon that so many software houses seem to churn out regardless. Regardless of how much users are paying for them, that is. There are three levels of difficulty with fast or slow option in each. At the top right-hand side of the screen is shown your current status. The figure at the top indicates the current score, the figure below, the current skill level. Below this is the number of spaceships remaining. You begin the attack with five. Bonus ships are awarded with every 1,000 points. At the bottom right of the screen you are shown how much ammunition is left. You can boost your supply by taking the spacecraft back off the top of the screen. This game will appeal to people who like flying down corridors. It requires a joystick.

BBC/ELECTRON SOFTWARE SURVEY





IT'S 1984. BIG BROTHER may be watching you. Can you risk loading some new games into your new hardware and having a good long session? Or should you do something a bit more useful? Learn to type, or perhaps play a stimulating game of chess? Whether you or Big Brother choose, the range of software available for the BBC will have what you need.

To start off with something close to every micro-owner's heart, consider this scenario; the CPU of your computer is being invaded by rebellious components! Resistors, tantalum bead capacitors, diodes, LEDs, are all approaching at high speed along the circuit tracks. Your only chance in Softspot's Transistor's Revenge is to manoeuvre your zap button along the sides of the rectangular 6502 occupying centre screen and blast the little upstarts back where they came from.

Occasionally, an indestructible "mains spike" will enter the circuit. This must be avoided or the game is up. Sometimes humble household tools, such as spanners and hammers, will appear at the edge of the many circuit tracks, What these archaic utensils are doing in a computer surpasses my understanding, but zap them anyway and get yourself a bonus score. Transistor's Revenge is a clever idea executed with great verve. The relentless onslaught of components is noisy, fast, colourful and compulsive.

Heist, also from Softspot, is a novel variation on the lifts, ladders and levels theme which will appeal particularly to the avaricious. You are the plump bowler-hatted manager of a bank and you must collect the moneybags lying around to deposit them in the safe at the bottom of the screen. Making your task rather difficult are four masked burglars and randomly exploding time-bombs.

To deal with the crooks, take one of the two hammers and give them a good "bonk". When your energy runs low a message appears; "Gosh, I need a cuppa!" and you must get to the steaming cup before you expire. Death gives you a pair of angel's wings which take you up to the great strongroom in the sky, accompanied by the death march from Beethoven's Fifth Symphony. Heist is a game full of good points and makes an amusing and exciting change from gorillas with barrels.

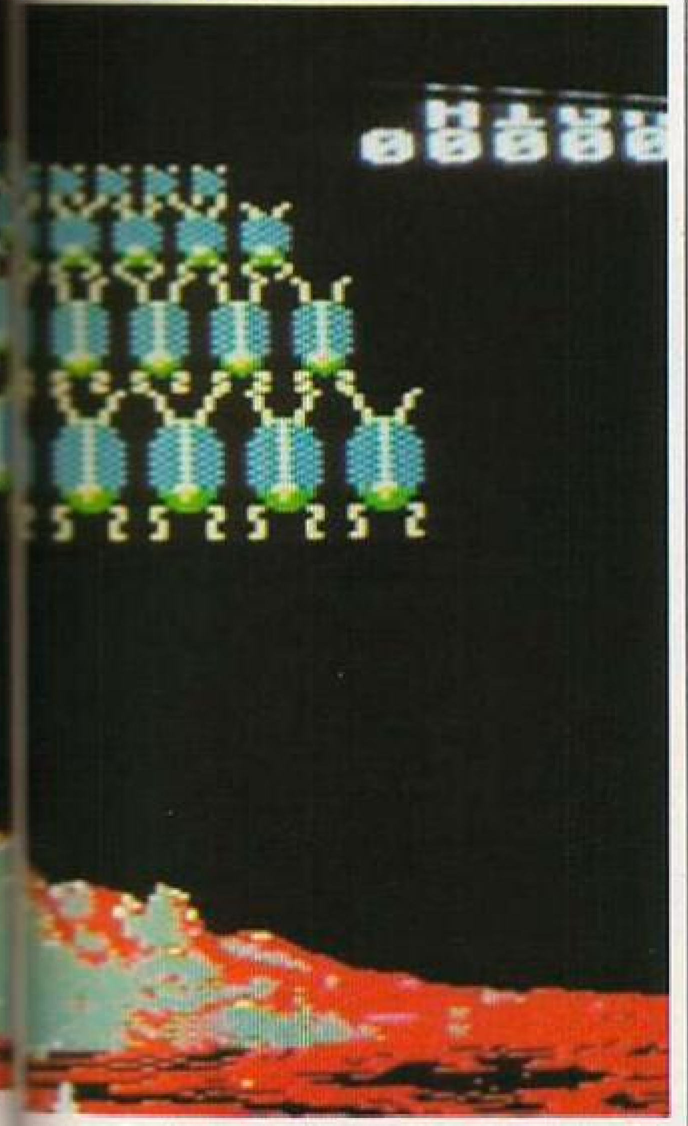
If you want to write a novel, or even a software review, on your word processor you should learn to type. In which case, look no further than BBC Soft's Vu-Type — in conjunction with Pitmans. This is a really excellent keyboard typing trainer, much eaiser and much more effective to use than a book and manual typewriter. Vu-Type comes with an explanatory booklet which is essential reading before starting.

Once the main program has loaded you can choose from a selection of graded drills and exercises which take you from one finger through to paragraphs and speed tests. The screen displays the QWERTY keyboard and, at the top, the exercise to be typed. The letter to be used is arrowed on the screen keyboard and mistakes are signalled by a bleep.

At the end of each drill or exercise you can get a report on your results, giving you the number of presses and errors per letter and an accuracy percentage. I do not want to sound boastful, but I think I should say that I achieved 100 percent accuracy on the letter J. Vu-Type allows you to change display colours and to select particular exercises from the menu. It is a well organised program which beats hands-down the old-fashioned methods of learning to type.

White Knight Mk. II is BBC Soft's

Pete Connors has a strange feeling that he is being watched as he tries out this month's crop of software.



Left: The Slicker Puzzle from DK'tronics. Above: Attack on Alpha Centrauri from Software Invasion. Below right: Carousel from Acornsoft.

challenger in the chess program stakes. It has a monochrome display with clearly-defined pieces; no chance here of the "Oh, I thought is was a pawn" excuse. Pieces are moved either by moving the cursor keys or by entering algebraic notation. A good point is that you can set a time limit on the computer's move at each level.

Thus, White Knight will not only play a very strong game of chess, but also a very quick one. In addition the program has all the usual options: it will move back or forward, play itself, change the board or solve problems.

There is, though, a more light-hearted side to BBC Soft, as can be seen in Canyon Battle, a compulsive shoot 'em up game. You have a small biplane with which you must try to destroy the invading Xarians up-river through the canyon. There are various types of Xarian ship; "uvaser beamers" which mess up your direction control, guided-missile ships, fighters, Gates of Fire, and the Imperial Flagship.

There are 24 canyons to get through; even at the lowest level it was not easy for me to get through the first one as I tried to avoid canyon walls and islands and attempted to destroy the alien robotic invaders. As well as getting through these canyons you must also shoot at least two out of every three invaders. Colour is used well in this game, suggesting different landscapes, but sound is rather limited. Canyon Battle is, though, a compelling game. If you get through all 24 canyons a mysterious message and a momentous decision await you. If it is "Would you like another game?" then the answer will probably be "yes".

More restful than Canyon Battle is Visions' Snooker, a very good simulation of the well-known ball and stick game. You can select a one or two player game and use with 10 or 15 balls. Strength of shot can be altered and you can even impart a little spin, if it takes your fancy. Both sound effects and colours are bright and clear.

Daredevil Dennis, on the other hand, is far from relaxing. In fact, it is as relaxing as watching Alex Higgins playing snooker. Dennis is the stuntman in a new film and will be fired if he needs more than three takes. His task is to ride his motorbike along the four lines displayed leaping over obstacles and holes.

At novice level he encounters only houses, trees, ambulances and a spider. However, at higher levels such as "Oscar Winner" he must also cope with a bouncing policeman and a helicopter. Invariably, Dennis comes off and ends up with his head in the ground and his legs waggling in the air. I never earned more than £190 for a day's work; those with a taste for living dangerously will find the game more rewarding.

Acornsoft's Carousel is unlikely to make your head spin with excitement. This is the game in which you must shoot the bunnies, owls and ducks on the revolving display. Extra points are scored for hitting, in the right order, the letters of the word BONUS. Sometimes a duck will come and try to steal your limited supply of bullets. When you have massacred all available livestock you can have a go at the lumbering polar bear. Then it all starts all over again.

Missile Control is a game which, by now, should hold no surprises for anyone. From your three bases you have to lay a protective covering of bombs to combat the alien missiles. Gemini's game is an adequate version of this old favourite, with both graphics and sound well up to scratch. In Caterpillar, also from Gemini, you have to help a hungry caterpillar called Arnold eat lettuces and avoid the poisoned mushrooms.

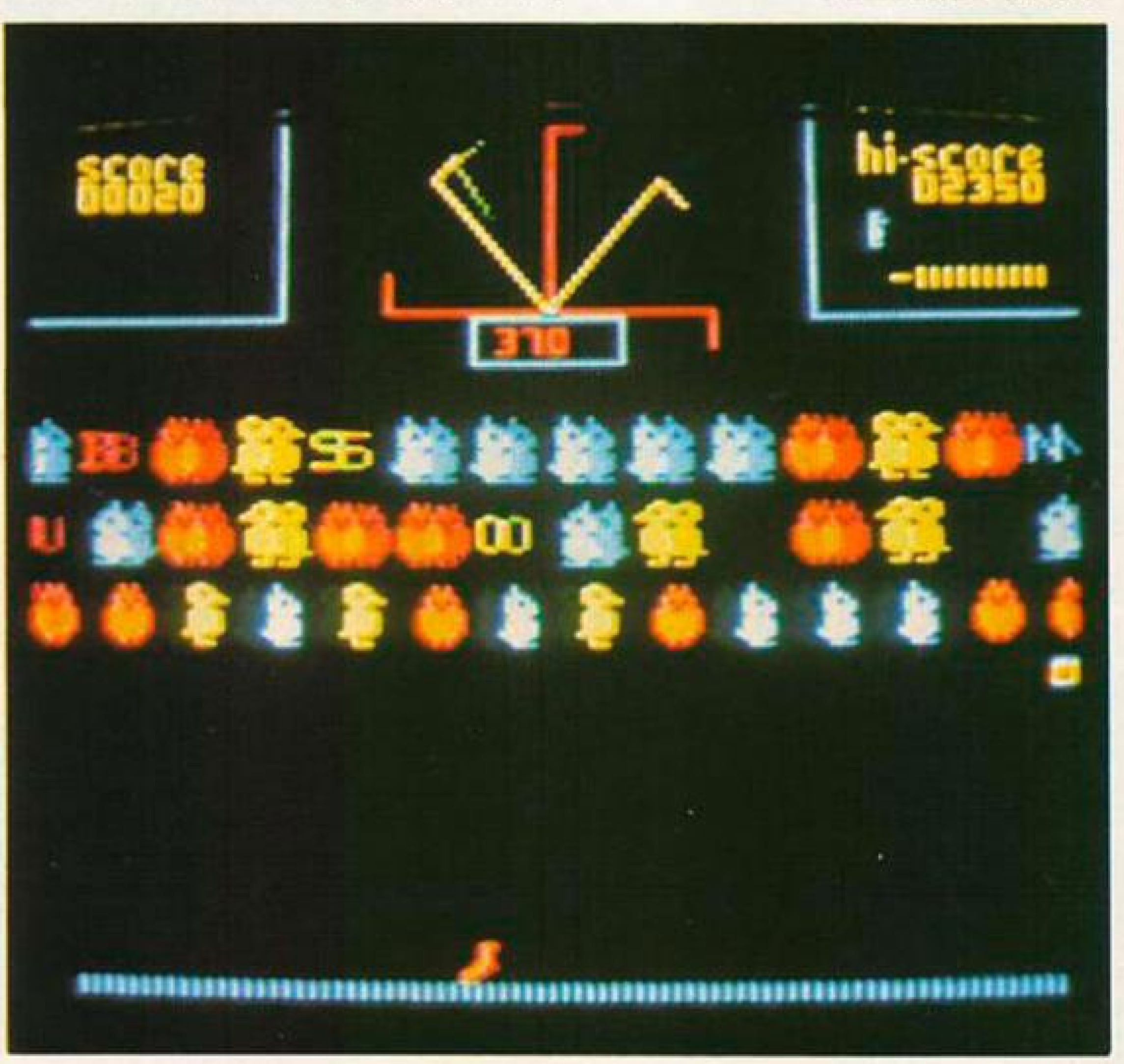
The more Arnold eats the longer he gets, so you have to be careful not to let him eat himself or crash into the edges. This snake-style game is quite good if you like that sort of thing.

Attack On Alpha Centauri, from Software Invasion, is a title with a good science fiction ring to it. The game itself is nightmarishly frenetic. On the mountainous landscape covered in red dust there is a flash of light. Suddenly hundreds of deadly "bug-eyed wasps" zoom into the sky, their serried ranks stretching far into the distance — for this is a "3D battle for supremacy".

The wasps speed toward you, getting bigger and bigger; do not shoot until you see the whites of their compound eyes. If you miss they wheel off and return to their pals. If you dispose of the blue and green ones, do not get complacent because next time it is the red and yellow ones. There is only one effective insect repellent, and that is your laser canon.

The same company's 3D Bomb Alley lacks

(continued on next page)



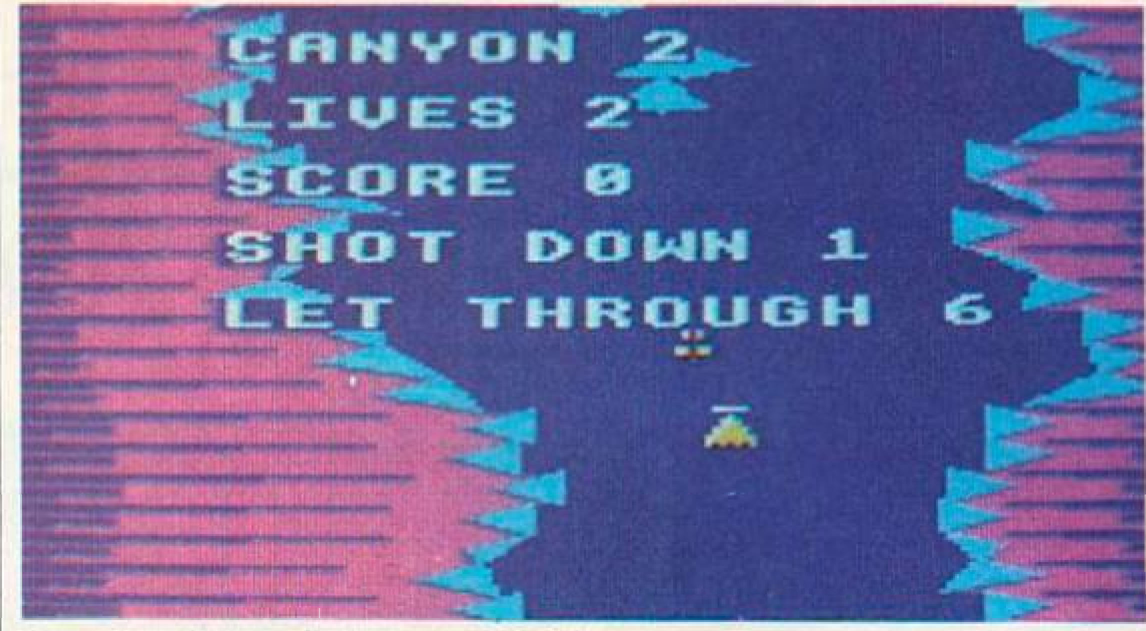
(continued from previous page)

any such excitement. In a pleasant cove with green hills and a deep blue sea, your ships are anchored. Out of the sky enemy aircraft wheel in, getting larger as they approach. Using the crosshair sights you must shoot them before they sink your ships. Unfortunately, the planes are too easy to hit and where the bombs fall bears little relation to ships destroyed. The sound effects are poor and the graphics, while pretty, lack movement.

Movement abounds, though, in Alligata's Monaco, a Grand Prix racing game. In order to get the 2000 points needed to qualify you must overtake other cars and avoid ambulances and oil slicks. The graphics are well done and the game is quite exciting. However, unlike its big brothers in the arcades there are no bends or chicanes or interesting background; just straight track which sometimes narrows. Despite the good sound effects its lack of graphic variety could lead to early pit stops for many players.

Competition of a more intellectual nature is involved in D.K.'tronics Slicker Puzzle. Here it is you against the computer. The puzzle consists of a series of concentric Zip Zap rectangles in different colours. These are fumbled up by the computer and you then have to rearrange them in the minimum number of moves. There are eight levels in this colourful and intriguing puzzle. After successfully completing a level you are given a coded message; all is revealed only after completing level 8. Anyone who enjoyed fiddling with Rubik's Cube will find Slicker puzzle an entertaining challenge.

From Program Power come Felix and the Fruit Monsters and Felix in the Factory. The first is a maze game which reworks the Pac-Man formula; Felix's job is to rush around protecting, rather than eating, the juicy strawberries and cherries. He can move the fruit, put the pursuing monsters to sleep by dropping an ether pool or blow them up by going over the magnetic pad in one corner of the screen. The monsters are angry apple-looking creatures — Granny Smiths, or possibly Golden Delicious — who mutate into something even nastier when they have consumed fruit. The graphics are clear and colourful and the game itself is quite tricky. Maze game fans should appreciate it.



Above: Detail from Canyon Battle from BBC Soft.

In the factory Felix has to keep a generator filled with oil. The oil is at the top of the screen, and to get it he must climb ladders and negotiate conveyer belts. Monsters — of course there are monsters — can be disposed of by giving them a sharp poke with a pitchfork.

Optima's Atomic Protector has nothing to do with cricket in the nuclear age but is, in fact, another maze game. You must protect your isotopes from attack in a secret research establishment. To do this you bounce away the "alien robots" before they reach critical mess. It is good fun, with entertaining graphics.

In Quicksilva's Mined Out your task is to guide Bill the Worm through a minefield. You cannot see the mines, so progress must be slow. As you progress you cut swathes to safety; when you approach a mine a warning sounds. Thus, although you cannot seem them you can, with logic and luck, avoid the mines. From level 2 on you get bonuses for rescuing damsels in minefield distress. These ladies look more like oilcans than damsels, but if you get a bonus, who cares?

Beeb Art, also from Quicksilva is a very good graphics program. The instructions are clear, and once you have read them, you can do all sorts of wonderful things; draw diagrams, faces, shapes.



Above: Detail of 3D Bomb Alley from Software Invasion.

Company	Program	Price
Acornsoft, 4a Market Hill, Cambridge.	Carousel	£9.95
Alligata, 178 West Street, Sheffield, S14 ET.	Monaco	£7.95
BBCSoft, 35 Marylebone High Street, London, W1M 4AA	Canyon Battle	£10.00
	White Knight Mk. 2	£11.50
	Vu-Type	£16.10
D.K.'tronics Shire Hill Industrial Est., Saffron Walden, Essex.	The Slicker Puzzle	£6.95
Gemini Software 18a Littleham Road, Exmouth, Devon.	Caterpillar	£9.95
	Missile Control	£9.95
Program Power, 8a Regent Street, Chapel Allerton, Leeds 7.	Felix in the Factory	£7.95
	Felix and the Fruit Monsters.	£7.95
Quicksilva, 13 Palmerston Road, Southampton.	Mined Out	£6.95
	Beeb Art	£14.95
Optima Software 36 St. Petersgate, Stockport, Cheshire.	Atomic Protector	£8.95
Softspot, 29 South Crescent, Prittlewell, Southend, Essex.	Transistor's Revenge	£6.95
	Heist	£6.95
Software Invasion, 50 Elborough Street, London, SW18	3D Bomb Alley	£7.95
	Attack on Alpha Centauri	£7.95
Visions, 1 Felgate Mews, Studland Street, London, W6.	Snooker	£8.95
	Daredevil Denis.	£7.95

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DRAGON DATA has refused to accept the challenge offered by newer arrivals on the market such as the Electron or the Elan and instead of producing a new machine has concentrated on enhancing its old one. A 64K version of the Dragon is now available at a number of high-street stores for £229.

As a long-standing Dragon user, I was excited to find out just how different the new machine was. On opening the box, I discovered that it looked just like the old one. It had the same large and sturdy plastic case, and the same keyboard with real keyswitches. Admittedly it was a smarter grey colour and had the number 64 rather than 32 alongside its rainbow-coloured logo. Closer inspection revealed that it had an extra DIN socket, beside the three for joysticks and the cassette port. This is an RS-232 interface which allows communication between the Dragon 64 and other computers or peripherals, such as serial printers.

I switched on to exactly the same boring green display that I was so used to on the 32. The manual that comes with the machine is identical to that for the 32, but there is an eight-page supplement that tells us all about the extras available on the 64. When switched on, the 64 is actually as 32 and is fully software compatible with the 32. So all cassettes and cartridges work as normal.

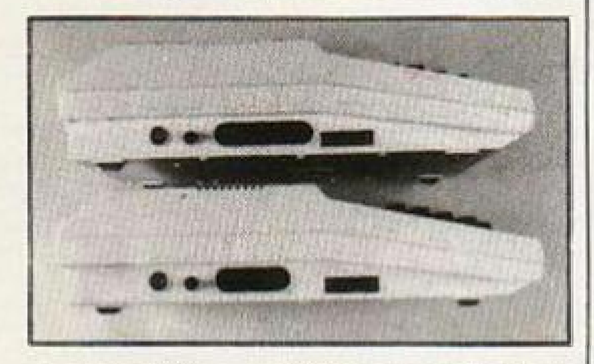
To "convert" it to a 64 you need to call up a little bootstrap by typing in EXEC. On doing this, you are greeted by exactly the same turn-on screen but this time the cursor has turned blue. Typing

```
PRINT MEM
```

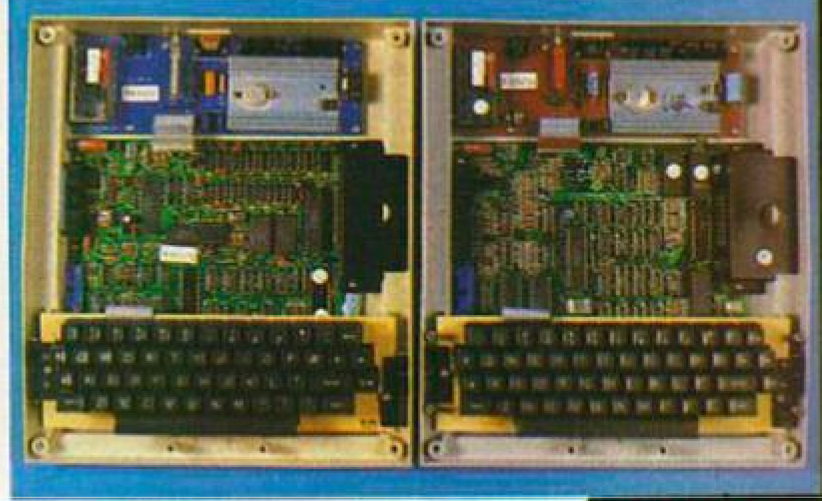
will tell you that you have 41,241 bytes of user memory available. This is 16,370 bytes more than the 24,871 free on the 32. Of course, with both machines this is extendable by clearing some of the space saved for high-resolution graphics, if you are not using them. Similarly, if you are working in machine code then you do not need the Basic interpreter so the whole 64K becomes available for user programs.

One thing that I have discovered is that some existing machine-code programs do not work in the 64K mode.

The space for the extended memory means that the Basic interpreter has to be shifted



elsewhere. Where would you guess it has been shifted to? The answer is that it has been placed over the address of the cartridge port, thus making the port unuseable. This does not affect games that may be used as normal — you need to turn off the power in order to plug in a cartridge, and when you switch on you are automatically in 32 mode — but it does affect such utilities as a cartridge word processor, or a machine-code monitor or assembler, all of which could make excellent use of the extra space that would be available.



This also denies the use of the cartridge port for other expansions; as a CPU extension bus, it can be used for a variety of peripherals, control and even for a second processor.

Disc drives also use the cartridge port but the operating system is provided by the disc OS and the Basic interpreter is not needed. This leads to one of the chief advantages of the Dragon 64. OS-9 is a powerful 6809 operating system with a great deal of software for business and other "serious" uses. OS-9 needs the memory space available to the 64 and cannot operate on the 32.

As already mentioned, the RS-232 port can be used for communication both with other computers and databases and with serial peripherals; a printer or a plotter. Extra commands are available for using the port; DLoad and DLoadM replace CLoad and CLoadM. Machine-code Pokes are needed to use the RS-232 as a serial printer port and further Pokes may be used to alter the baud rate — the speed at which characters are transmitted. This may need to be altered to match up with the communicating equipment.

The port may also be used with a Modem or acoustic coupler to send or receive data through a telephone line. There is another drawback here though as many databases are transmitted in teletext mode which is not available on the Dragon.

The other new facility available on the 64 is auto-repeat on the keys and, no doubt in answer to criticisms of the 32, a much faster keyboard response. I am no touch-typist but I frequently find on the 32 that if I type "the" or "Run" quickly, I often end up with "te" or Rn because the keyboard cannot keep up with me. This is put right in the 64 and may be added to the 32 mode on the 64 machine with, inevitably, another series of Pokes. These do not work on the old 32 machine; I tried.

The infamous USRO bug has been put right on the new machine. All USR1 USR2 etc., calls now work instead of all defaulting to USR0. In fact, there was a cure for this on the old machine. If you defined user calls as USR01, USR02 etc., they worked correctly. They have also had to juggle with numbers a little so that memory or variable pointer addresses do not become negative numbers if they go above 32768.

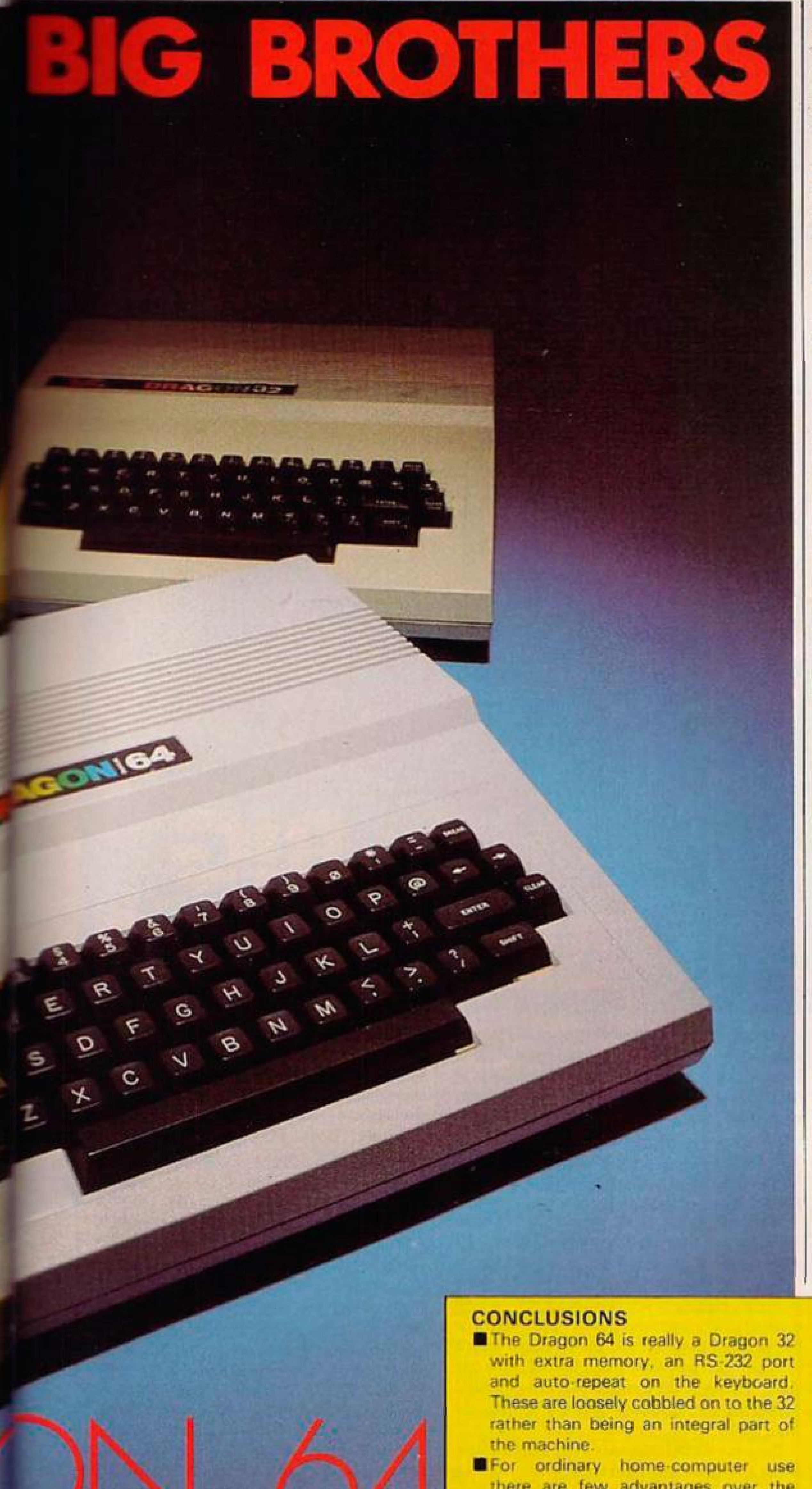
The 64 then is a powerful business machine if one wishes to make use of the RS-232 port and/or OS-9 with discs but for the ordinary man in the street there seem to be few advantages and even some disadvantages. The extra memory will appeal to some but do not

Are the extras worth the extra? David Stobie takes a Peek and a Poke at the 32's big-memory brother.



DRAGO

BIG BROTHERS



forget that 32K is already a lot of memory and should be plenty for most home-computer applications. The 64 is really a 32 with the extra facilities stitched on instead of a really new machine. Execs and Peeks and Pokes are needed to use most of the new facilities when they should be an integral part of the machine.

After a year-and-half's experience, I think it is worth having a second look at the Dragon 32. Theoretically it has one of the very best eight-bit processors, the Motorola M6809E which is halfway between an eight- and a 16-bit micro with a large number of instructions.

The Extended Microsoft Colour Basic is a very complete and powerful version with a number of graphics instructions, Paint, Fill, Circle etc., not available on other micros.

The line editor takes some getting used to but works well. The Dragon's greatest disadvantage is the alphanumeric display. Only 16 lines of 32 characters. No lower-case letters, no variation in Ink or Paper, just the same boring black on green — or green on black if you like. The four-colour graphics high-resolution modes seem to choose the ugliest colours possible.

I know that secret colours may be extracted and that text may be added to the high-resolution — 254 by 200 — display by some clever machine-code programming or tedious Pokes, that upper- and lower-case characters may be user-defined on the high-resolution screen but this should not be necessary; they should be there as standard.

However, there are compensations. The keyboard is physically very good with solid typewriter keys and a spacebar. There are no single-key entries as there are on the Sinclair computers, there are no programmable function keys, though this is easy to simulate:

```
IF INKEY$  X THEN GOTO
```

The cassette interface is very reliable and there are few Loading and Saving problems.

Other hidden advantages are that the joysticks ports accept analogue inputs and so may be used for temperature sensors or other transducers. The printer port may also be used to provide digital input/output facilities.

The Dragon is software-orientated so that almost any facility needed can be provided by a program instead of an add-on piece of hardware. For instance Dragon Data with its Compuvoice cassette showed how easy it was to have a speech synthesiser when most other computers need a dedicated chip.

It seems a shame that Dragon Data has not put right the shortcomings of the 32 with its new machine. It might have meant taking a bit of a risk, perhaps abandoning the compatibility with the Dragon 32. But I am sure it would have been a great success.

CONCLUSIONS

- The Dragon 64 is really a Dragon 32 with extra memory, an RS-232 port and auto-repeat on the keyboard. These are loosely cobbled on to the 32 rather than being an integral part of the machine.
- For ordinary home-computer use there are few advantages over the Dragon 32, but the 64 will come into its own with discs when the OS-9 operating system can be used and the RS-232 port handles communications.
- This indicates a business machine, where it comes into competition with a large number of other computers, most of which have better display facilities. However at the low price of £229 it is still good value. ■

ATARI 800XL

Fireball — or just go-faster stripes for the old 800? Jack Schofield sits at the controls of the new XL.



BIG BROTHERS

THE ATARI 800XL is just the same as the 600XL, reviewed in the November issue of *Your Computer* — except for one thing: it has 64K of memory instead of 16K. The larger memory is arranged as eight 64K by one-bit chips at the back of the main board, behind the cartridge slot. Thus the 800XL case is slightly deeper.

The 800XL is also pretty much the same as the old 800 in most respects, except for having four extra graphics modes and two fewer joystick ports.

Like the 600XL, the 800XL is a very well designed and well-made machine. It should be, being essentially a reworking of the familiar Atari 800, first launched at the end of 1979.

The thinking behind the XL range is, however, radically different. The original 800 was designed to be both a consumer product and a rival to the main competition, the Apple II. It was designed to be internally modifiable by the average user. Thus the 48K memory was on three 16K cartridges, only one being supplied as standard.

The operating system was in a separate cartridge, in case someone wanted to use alternatives, as later appeared. Similarly the Basic was on yet another separate cartridge, so it could be removed and replaced with an alternative language or assembler — for example the Atari Assembler Editor or MicroSoft Basic II — or simply to free extra memory space for machine language programs.

While all this thinking was very laudable in 1979, it is out of date today, when the competition is not Apple but Commodore.

Now the accent is on making the cheapest possible high-specification machine, which means putting everything on a single board in the smallest possible number of chips, which is what Atari has done. The 800XL now has about a third of the number of chips of a BBC Model B, and far fewer pieces than the old Atari 800.

Thus the 800XL has only eight RAM chips, while the Basic and operating system are on 8K and 16K ROMs on the main board. You cannot remove them, though of course you can still switch out the Basic to use alternative languages and games. But the result is that no internal expansion is possible.

Therefore, Atari has provided for external expansion, by giving access to an edge connector on the main board via the back of the case. This will lead to a cage-type expansion box, familiar in the U.K. on many small micros.

Apparently some of the existing independent cards such as the Bit-3 80-column card, Z-80 add-ons and the 8088 card, some of them designed to plug inside the 800 instead of a memory card, will be adaptable to the expansion box. Atari itself has many other ideas for its own add-ons too.

The previous 800 also had an external expansion unit, the peripheral box. This hung on the serial output port and provided four RS-232C ports and a parallel printer port for something over £100.

Instead Atari is now producing all its peripherials with two serial ports, and offering a range of four printers which all work on this.

For example, you can plug a disc into the micro, cassette recorder into the disc, and a

letter-quality printer into the cassette. Unlike the BBC Micro, you do not need an extra chip to run discs. Incidentally, these new peripherals also run on the old 400 and 800.

Here you discover the real beauty of Atari's tiny operating system, which is the same in the 800XL as in the 800 and 400. If you want to Save the file test to disc it is just

Save "D:Test"

To Save it to cassette just use "C:" and so on.

If that is too easy, there are CSave and CLoad for cassette operation, plus eight channels that you can use in the usual Open #1 style. All this means that while the serial bus is inherently fairly slow, it is very convenient to use.

Turn on the power and the 800XL comes up with white letters on a blue screen and 37.5K free to Basic. The mode 0 text screen is 40 columns by 24 characters, with a two-character margin, plus a border outside that to preclude losing text due to overscan on the TV. It is more legible than the Commodore 64 screen, though there is slightly less memory free to Basic.

Typing GR.1 changes the display to a mode 1 screen with five colours and a double-width character set offering 20 characters by 24 lines. There is a four-line mode 0 text window at the bottom of the screen, which you can get rid of by adding 16 to the mode number.

Typing GR.2+16 puts you into mode 2 without text window, with five colours and double-width, double-height characters. The format is 20 characters by 12 lines. This is the last of the three character sets provided, except that the XL range also has a set of international and foreign language characters, including the good old £ sign.

Incidentally, each character set includes 29 block graphics characters which can be entered using Control from the keyboard.

There are 16 graphics modes in all, with the highest resolution being 320 by 192 pixels. The maximum number of colours is 16 or, alternatively, it is possible to have a maximum number of 16 shades of one colour.

A five-colour Mode 2 screen requires only 420 bytes of RAM, and the maximum taken by any mode is under 8K. This gives the Atari a considerable advantage over some machines that use from 8K to 20K of RAM for this.

The modes are controlled by a custom graphics chip called Antic, which has as its program the Display List. By Poking the display list it is possible to mix a number of modes on the screen at the same time and thus increase the number of colours. In fact it is possible to display all 16 shades of 16 colours to produce 256 colour patches. But this is for display only — I can see no practical value.

The colour information is held in shadow registers using the Setcolor (SE.) command from Basic, and these are used to update the hardware registers. It is simple to use variables in Setcolor statements and thus change or cycle screen colours rapidly. The BBC uses VDU commands in a similar way.

Other Basic commands like Plot and Draw to make it easy to produce graphics, and X10 is used to fill areas — among other things. There is no Circle command.

The Atari also has hardware sprites, which the Acorn BBC and Electron micros lack, but which the Commodore 64 has. The Atari has four eight-bit sprites or "players" and four two-bit missiles which can be combined to make another sprite if required. This is fewer than the CBM-64, though it is quite enough considering that, as with the CBM-64, there are no sprite commands in Basic.

All round the Atari graphics are about as powerful as the BBC and Commodore 64 graphics, if not more so. The Atari has the advantage of more modes and more colours than either. The graphics takes up much less RAM than the BBC modes and are much easier to use than the Commodore 64's graphics which are unsupported by Basic.

The Atari sound commands also relate to BBC and Commodore 64 sound commands in a similar way. The Atari has four synthesised sound channels numbered 0 to 3, with parameters to control frequency — i.e., the note — tone quality — from rasp to clear tone — and loudness respectively. Thus a sound command takes the form Sound 0,212,10,8.

This makes the sound far easier to use than on the BBC, though of course delay loops have to be used lacking the BBC's long string of envelope commands.

The sound quality of the Atari is also better in being output via the TV, instead of using a small built-in speaker.

The limitation of the Atari sound is that Basic only offers notes from 0 to 255. However, as the Atari's tones are divided between 3.5 octaves, there is a reasonable match between tones and at least a few musical notes.

The Atari contains a special custom sound chip called Pokey, and the hardware can be Poked to produce sounds directly. This provides a range of about nine octaves, very close to the Commodore 64.

The Atari also has a further sound facility, which is, I think, unique. It uses a dedicated stereo cassette recorder with one data track and one sound track. This means sound from the tape can be output via the TV, even during the loading of a program, as is done on Atari's Lone Raider game. This makes the Atari ideal for things like learning conversational languages, and for integrating real, not synthetic, voices into programs.

The Atari standard Basic's good points are that it contains a good range of commands, has syntax checking on line entry, provides long variable names, is fully debugged, and takes up only 8K. The bad points are that it is not very structured, and that it is slow. Note that it is the Basic that is slow, not the hardware. Anyone who has played Atari's Defender will now that it is faster than Planetoids on the BBC or anything on the Commodore 64.

Taking Benchmarks 1 to 7 from *Kilobaud Microcomputing*, the Atari 800XL averages 29.2 seconds, which is between the Commodore 64 (25.1 seconds) and Sinclair Spectrum (33.6 seconds). But the BBC is *much* faster (10.7 seconds)!

Thus the Basic is a lot better than the primitive version 2 Basic of the Commodore 64, but not as good as the 16K Basic of the Acorn BBC — which is hardly surprising as it is only half the size. Probably the access that BBC Basic provides to the assembler is worth 8K of RAM.

The Atari's use of long strings and string slicing, adopted later by Sinclair, and syntax checking on line entry make the Atari suitable for Sinclair owners' upgrading.

The Atari already has a good selection of peripherals — including disc drives and printers — from the 400 and 800. These work with the XL machines. But a new range of peripherals is being launched in the new styling. These including a number of items simply not available for the BBC or Commodore 64, including an excellent touch tablet, a track-ball and the Gibson light-pen.

Printers include a dot-matrix model, a pen printer/plotter like the one for the Oric, Sharp and Tandy micros, a thermal printer, and a £299 letter-quality printer. ■

Benchmarks

Machine	CPU	BM1	BM2	BM3	BM4	BM5	BM6	BM7	MEAN
BBC Model B	6502	1.0	3.1	8.3	8.7	9.2	13.9	21.9	10.7
Commodore 64*	6510	1.0	10.5	19.2	20.0	21.0	32.2	51.6	25.1
Atari 800XL	6502	2.2	7.3	19.7	24.1	26.3	40.3	60.1	29.2
Sinclair Spectrum	Z 80	4.8	8.7	21.1	20.4	24.0	55.3	80.7	33.6

CONCLUSIONS

- The Atari 800XL, Commodore 64 and BBC Model B are three micros that stand out as being far superior to the Dragons, Tandys, Orics and Lynxs. The Spectrum is just too expensive when raised to the same specification. These three have better hardware, better keyboards, better Basics, more peripherals and better software. The average user would probably be delighted to own any of them. But if you have to choose:
- The Atari has the best games as well as a wide selection of good software, languages and peripherals, though there is very little U.K. business software. The real catch is, the software is expensive.
- The BBC has the best Basic and is best both for education generally and for learning to program. Also, it does not need a dedicated cassette recorder, like the other two. The catch is that, including disc chip, it is twice the price of the others. Also it has the smallest available RAM.
- The Commodore 64 is cheapest of the three, is well supported, and looks the best bet for home/small business software, though it currently has less software than the other two. The catch is, it has a primitive Basic and you would have to be batty to choose it for learning to program.
- The old advice remains the best advice: find the software you want, and buy the machine it runs on.

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THE LYNX HAS BEEN available in 48K form since the beginning of 1983. Camputers has recently launched a 96K memory version with an enhanced ROM set, to be followed shortly by the 128K Lynx.

The additional 4K ROM in the 96K Lynx is the first in a series of planned expansions for the Camputers microcomputer.

The prices of the Lynx are as follows:

48K Lynx £225
96K Lynx £299
128K Lynx £445 available soon
48K to 96K upgrade £90

Not all the additional memory in the 96K Lynx is available for Basic programming. The extra 48K of memory has 24K masked out by the ROM. The masked memory has to be accessed using an Ext command and is only suitable for non-program type data storage.

The memory break down is as follows:

96K Lynx
38.5K Basic 23.5K Data 34K System
48K Lynx
14K Basic 34K System

The majority of the system memory is taken up by the colour screens that give the Lynx its excellent colour and pixel resolution of 256×248. Externally the only difference between the two machines is the inclusion of the number 96 on the Lynx logo.

Internally there are several subtle differences. The 4K Eprom in the spare socket is the most obvious, the PCB is now at issue three and incorporates all the early 48K machines wiring patches.

The major change occurs in the area below the speaker where the 6K chips have been replaced by 64K devices with changes to the

```
 1 LET a$=""
 5 POKE 23296,7
10 FORMAT "t";2400
20 OPEN #4;"t"
30 PRINT INKEY$#4;: GO TO 30
45 CLEAR #
46 FORMAT "t";1000
47 OPEN #3;"t"
50 LET b$=""
55 FOR x=0 TO 17
52 FOR y=0 TO 31
55 LET a$=SCREEN$ (x,y)
60 IF a$="?" THEN GO TO 70
68 IF a$="," THEN LPRINT b$: LET b$=
"": GO TO 70
69 LET b$=b$+a$
70 NEXT y
75 NEXT x
80 LPRINT
90 CLEAR #: STOP
```

Figure 1.

PCB links to accommodate the new larger memory devices.

The quality of the keyboard is poor for a proper keyboard machine. The reading of the keyboard was inconsistent as was the required keystroke travel needed to register an input. There were times when it appeared that my two-finger typing speed was too fast for the Lynx, which is not a good reflection on the characteristics of the display speed.

On virtually all cassette tape machines the remote socket is next to the mic socket. This enables the use of any one of a large number of remote microphones. Why, therefore, does the earphone plug colour match with the remote plug instead of the microphone plug matching the remote plug?

The cassette interface was extremely sensitive to levels, an additional leaflet on operating the Lynx wth a cassette recorder was provided but this is no substitute for an efficient reliable interface.

The television display from the 96K Lynx produced a lot more dot crawl than the 48K machines, but this I would suspect is merely a problem in the factory tuning of the modulator circuitry.

The version 2.0 of the Lynx ROM is now supplied with all new Lynx 48K and 96K computers. The Lynx executes a memory test on power-up to determine whether it is 48K or 96K, the latter being denoted by two beeps on switch-on.

Some of the original ROM errors have been corrected and a couple of the mathematical algorithms improved for speed.

The Lynx has both parallel and a serial output port sockets. The parallel output requires an interface pack before this mode of operation can be implemented: the pack costs £50.

The serial port is implemented in software, but this is not a true RS-232 serial facility. There are only three lines, in, out and ground, no DTR or CTS. It appears that the serial interface will only be suitable with printers capable of running at 2,400 baud and having a fairly substantial input buffer. The manual suggests the Seikosha GP-250X as being suitable.

Without adequate handshaking, I would suspect that the Lynx will not be able to act as part of a micro network. It was a real struggle to get data transfer via the serial interface in order to obtain the few listings that form part of this review. Figures 1 and 2 provide the programs used to establish the link.

I was only able to dump the Lynx data to a Spectrum screen through the serial interface and then process from there. It could be said that the Lynx is not meant to be networked to other micros; at this price it should.

Joystick and light-pen commands are incorporated in the 4K ROM extension. The joysticks require an interface — £15.

The Lynx version 2.0 ROM command set is well structured and reasonably comprehensive. The error messages are good and the line entry syntax check useful.

Many of the facilities of Lynx Basic remind me of BBC Basic. The structures are very good but lack the very simple On . . Goto and On . . Gosub. The ability to use machine code from within a Basic program and the use of VDU-type commands are also reminiscent of the BBC-type Basic.

The lack of multi-channel sound facilities is very noticable, the new inbuilt sound commands of Laser, Zap, Klaxon etc., are poor.

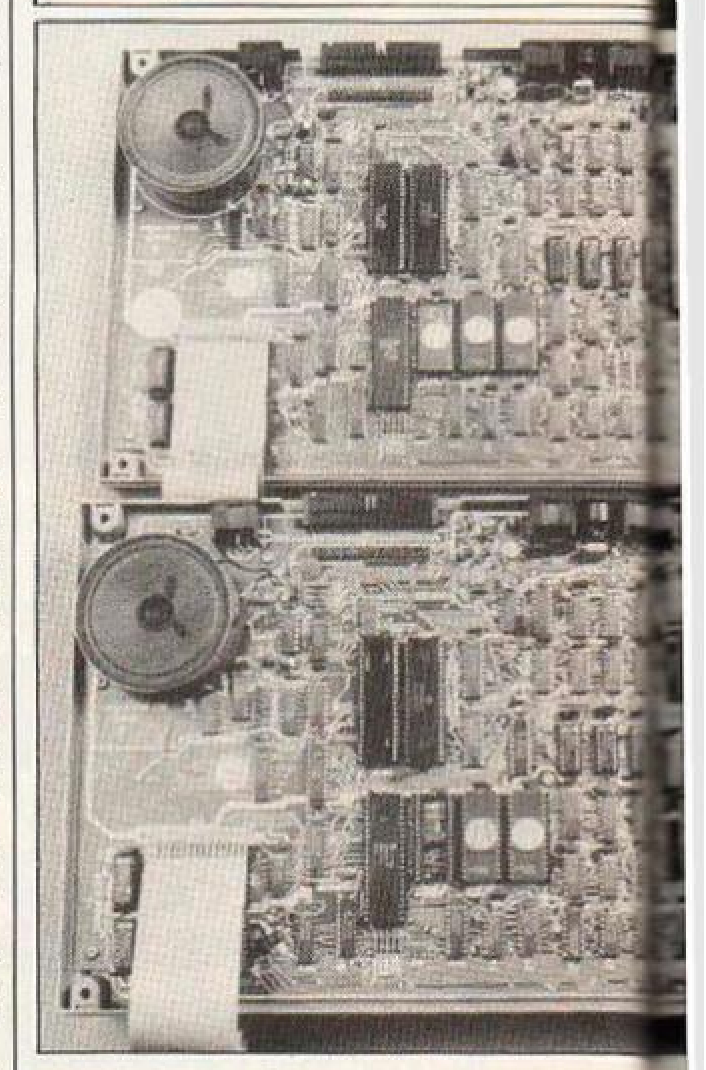
One bright spot on an otherwise cloudy horizon is the built-in monitor. This should enable fast machine-code program development when coupled with the quite reasonable set of Basic to machine-code links.

The 23K Data store can be segregated into 48 discrete components in any combination of length and number to fill the available data store. The extended Lynx Basic command Ext is used to prefix a series of commands similar to Basic's Read, Data and Restore i.e., Fetch, Store and Back.

Data files can be Chained, Saved and Loaded, even stored in integer format. Whether this is a new way of partitioning to improve memory efficiency, or just a means of

```
100 CLS
103 DIM A$(40)
105 LET A$=""
110 FOR A=14576 TO 15020
115   IF PEEK(A)=64 THEN GOTO 140
116   IF PEEK(A)=192 THEN GOTO 140
120   IF PEEK(A)>32 AND PEEK(A)<128 THEN
 LET A$=A$+CHR$(PEEK(A))
130   IF PEEK(A)>128 THEN LET A$=A$+","
+CHR$(PEEK(A)-128)
132   IF PEEK(A)=0 THEN LET A$=A$+","
135   IF LEN(A$)>32 THEN GOTO 170
140 NEXT A
151 LPRINT A$
152 PRINT A$
155 BEEP 2000,100,60
160 STOP
170 LPRINT A$
171 PRINT A$,
180 LET A$=""
190 GOTO 140
```

Figure 2.



BIG BR

trying to get some use out of memory not properly bank switched, I shall reserve judgment.

The remaining extended Basic commands include facilities for circle, clear window, fill triangle, error trap and video reset.

The 96K Lynx is supplied with an additional eight-page 96K User Manual, which briefly explains each of the new commands.

The fact that only eight pages are required to explain the benefits of the 96K Lynx over the smaller 48K machine is more a reflection on the inadequacies of the documentation than poor value for money. I think that more detailed explanations would be advisable, but this could be said of the Lynx manual as well.

The data store concept as implemented is not documented elsewhere in other literature and I think that in this area at least a few guidelines on various uses with examples are essential if the majority of Lynx users are not



OTHERS

to allow this memory to fall into disuse by default.

When the Lynx was launched nearly a year ago, the price of the 48K Spectrum was £175, only £50 less than the 48K Lynx which, when taking into account the keyboard, superior colour graphics and built-in monitor, was probably reasonable even allowing for the Lynx's bad points.

Today the price of the Spectrum has fallen to £130, but the Lynx price has remained the same where it now faces competition from the Electron and more seriously the latest offering from Atari and the Commodore 64.

The Atari and Commodore machines have proven, although limited, CP/M capability and large libraries of quality software, if Commodore can quickly overcome the current reliability problems of one of its products and Acorn is able to manufacture the Electron in large numbers, life will be very difficult for the Lynx.

CONCLUSIONS

- The keyboard is one of the worst real keyboards I have come across for predictability. Better than most moving-key keyboards, but only just.
- The vertical wrap-around scrolling of the screen is not implemented on any other popular micro and can be a real nuisance.
- Not all the RAM is available for programs. Setting aside that required for high-resolution colour graphics as reasonable, 40 percent of the remainder is for data only and is not available to store a Basic program.
- The cassette interface reminds me of a ZX-81. Large memory can mean a large program and if it is stored on cassette, it has to be capable of extremely reliable loading.
- The serial port is not an RS-232 implementation with DTR and CTS control. Just three lines make computer-to-computer working extremely difficult. The interface is configured for a printer with a buffer.
- There is no parallel printer facility without the hardware which is an add-on extra.
- It is an expensive games machine, without the huge library of software available to some of its rivals. As a business machine it still cannot run CP/M. For this you need the 128K Lynx and that is £445 and not yet available.
- One of the problems of expandability and longevity is that previous system failings tend to be perpetuated in order to sustain the idea of an expandable system. It may be more politic to remove some of the design restraints and go for a more user-friendly approach.

Spot the difference. The two-tone grey Elan in the foreground is the original wooden dummy, while the dark grey machine in the background is the finished product.

As the countdown continues till the £200 Elan hits the shops Meirion Jones finds out how a new computer is designed

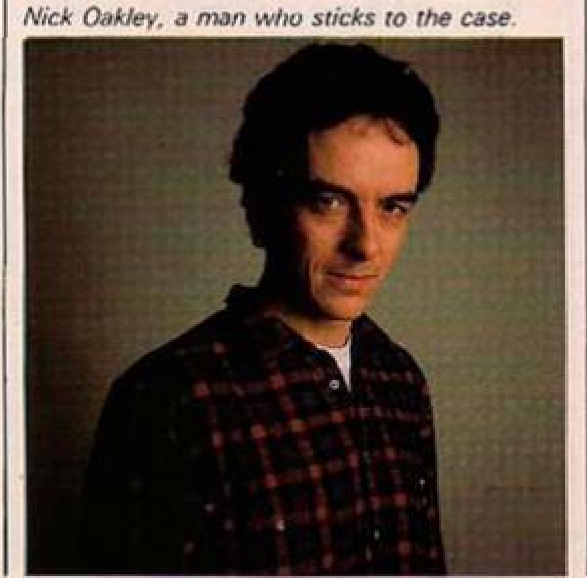
PANIC HIT the Elan team just three days before the press launch of their new computer. A vital component of the keyboard, a rubber mat cushioning the plastic keys, was not ready but the show still had to go on.

Geoff Hollington and Nick Oakley who designed the case and keyboard spent 72 hectic hours chopping up rubber membranes from old intercoms and supergluing them into place beneath the keyboards of the demonstration machines. As often as not they found themselves glued to the keyboard, the case or the table but with the help of an out of work designer they dragged off the street, by the morning of the launch they were able to get themselves unstuck and turn up with enough machines to show the press.

What made the biggest impression though, was not the stylish looks of the Elan but the specification. No wonder Robert Madge the team leader of the whole Elan project was smiling as he outlined the capabilities of his micro.

With 64K RAM, full size keyboard, built-in word processor, four-channel stereo sound, the highest resolution and choice of colours of any home micro, 80-column display plus a built-in joystick and all the interfaces you could want for £200 even the most hardened computer journalists were impressed. It was only when Madge announced that the machine would not be on sale till April that the cynical smiles returned to their faces.

Nick Oakley, a man who sticks to the case.



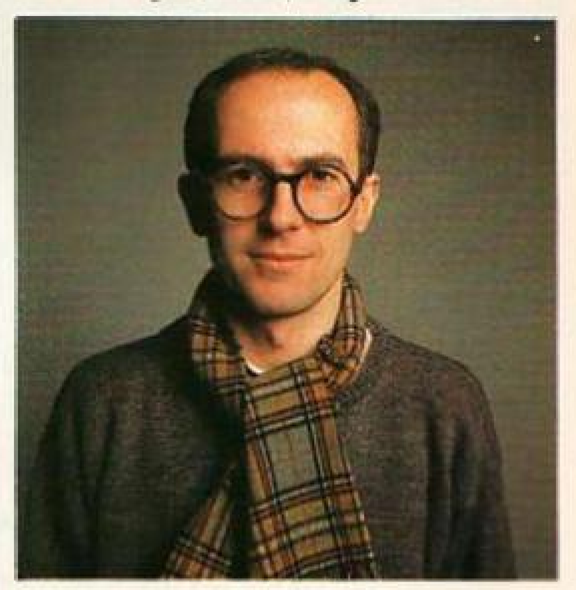
Until the press launch the Elan had been the best kept secret in home computing. The story started in the Summer of 1982 soon after Sinclair launched the Spectrum. David Levy of Intelligent Software, IS, was approached by a bank on behalf of a mystery backer which wanted IS to design a home computer to rival the Sinclair.

Intelligent Software is best known for producing programs like Cyrus IS Chess which is the toughest chess game on any home computer, and no wonder since David Levy made his name as a chess grandmaster. But IS has produced programs for all the popular home computers and also has considerable hardware design expertise.

Past work includes designing a pocket chess game for Computer Games Limited and the massive Electronic Challenger chess robot. IS had also designed the Biztek pocket calculator, which includes an electronic diary, for

THE ELAN STORY

Robert Madge, left, is the project leader of the Elan development team most of which was drawn from Intelligent Software, IS. Although IS had not produced a computer before it had written popular home micro programs like Cyrus, IS Chess and designed products like the Biztek electronic diary, and Chess King and Electronic Grand Master chess machines which are on the table. While IS designed the insides Geoff Hollington, below, designed the outside.



Domicrest, an Anglo-Indian trading company which is involved in the Elan project.

When the approach came from the bank IS had to ask themselves "could we design a successful mass-market home computer". They had already drafted an outline for a video games machine and in the course of rewriting programs for different computers

"Could we design a successful home computer?"

had worked out their own ideas for what they would and would not like to see in a micro.

As Madge says "the Spectrum is a very good product indeed"; so the first idea was to produce something like a Spectrum but with a better keyboard and interfaces for around £100. Madge found himself "going down the same sort of path Oric went down" but felt that by the time his machine came out it would be outdated.

Having rejected the Oric-style solution the IS team thought things through from scratch — "if we could have everything what would we have." Obviously such an ideal machine would be too expensive for most buyers but by making a few compromises Madge felt that there was still "a technological window for a product which answered most people's complaints about existing home computers at a reasonable price." Interfaces and expandibility were a priority from the outset because IS wanted to make a machine "which would still be wanted four or five years after the original design decisions were taken."

"We had reverse engineered many machines" says Madge "so we could learn the lessons of other people's successes or mistakes." For instance "the Apple had a few too few keys and we had seen the advantage of products like the Atari which give a wide colour choice. We are a programming house so we wanted a nice machine to program with."

By October 1982 the project had a code name, DPC — Damp Proof Course, in case anyone dropped the plans on a bus, and an outline specification, The DPC which was eventually to become the Elan would have at least 64K of RAM, full-travel keyboard, built-in joystick, ultra-high resolution graphics and as many colours displayed on screen as possible. A 64-track connector would be linked to an expansion box capable of running twin microfloppy disc drives or taking add on RAMpacks.

In great secrecy the outline was taken to three teams of designers to put forward their ideas for what the "DPC" should look like. "It was shrouded in mystery" says Geoff Hollington, who was impressed by the masonic air of conspiracy of the whole proceedings "it could have been P2". Madge asked how long it would take Hollington's firm to produce initial sketches. "We very stupidly said seven days".

That week Geoff and his associate Nick Oakley found themselves working all hours. Neither of them had ever designed a computer before but they were both convinced that it was time to get away from "current bun" designs. Hollington calls them current buns because most home computers are just a "printed circuit board sandwiched between two sheets of cream plastic, with a few keys sticking out of the top."

"We're coming out of that phase. I cannot see the next Acorn being a boring old box with keys on like the Electron." Hollington thinks that computers are now becoming an ordinary household item which people expect to look good around the house. He wanted to make the appearance of the "DPC" seduce people into buying the machine yet say a little about the technology."

His approach paid off when he and Oakley returned to show their sketches. Although they were so tired that "neither of us was capable of coherent conversation" Madge told them "you have got the job."

(continued on page 81)

(continued from page 79)

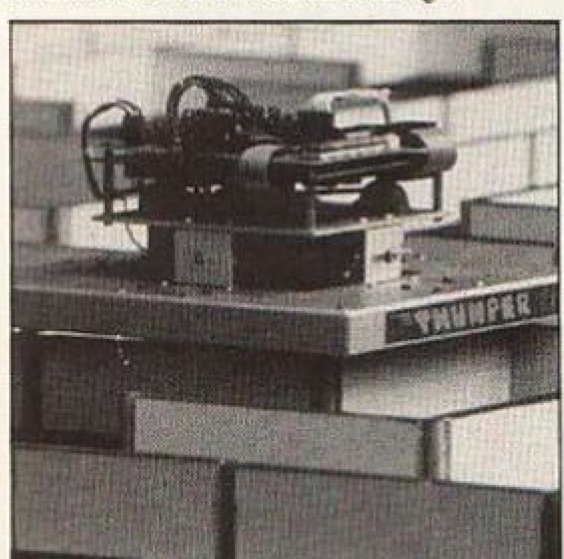
The "DPC" project was still being run from the IS office — the gnomes in Tottenham Court Road — as Hollington calls them, although by now the team involved was quite large. They had opted for a Z-80 central processor on the grounds of compatibility because it would allow them the option in future of running CP/M business software.

They wanted to use standard components wherever possible "there is no point in reinventing the wheel" as Madge says but they found that there was no good chip set which would allow them to do everything they wanted on graphics and sound. Madge regards the MSX chip set for instance as a "low-quality standard" which may allow the Japanese to break in at the bottom end of the market but which is "fundamentally limiting".

Instead he used Nick Toop, who helped create the Acorn Atom, to design a custom graphics chip. The idea was to create a "soft chip" which could be controlled as easily as possible from programs. Fixed items were kept as small as possible.

This "Nick" chip as Elan now calls it allows the machine to display up to 256 colours on screen and gives a resolution of up to 672×512 — although not at the same time. It is possible to mix modes on screen and to create windows on to areas of text or graphics as on the Atari. With one exception the "Nick" chip has allowed Madge to achieve his ambition of combining "good graphics on different systems and putting them all together."

You can use character mapped or pixel mapped graphics or parallel attributes as on the Spectrum. The only thing missing is sprites. Madge explains that they had the choice of ultra-high resolution or sprites and in the end they decided to make sprites available later as an add-on cartridge.



Thumper — chip man Dave's micromouse.

"Your're always making compromises" as Madge says, and although the original idea was to build both an asembler and a simple word processor into ROM limitations of space led to the assembler being left out. The word processor takes advantage of the Elan's 80-column display while the assembler will be available later on cartridge.

While Nick Toop was working on the "Nick" chip Dave Woodfield was designing the sound chip which needless to say was christened "Dave", Stereo sound was one of the features built-in — you do not need a stereo television — a pair of Sony Walkman headphones will plug straight into the back.



"With obsolescence built out" is Elan's slogan emphasizing expandability — unfortunately this mixed bunch of IS programmers who worked on the Enterprise only help to obscure the message.

Dave Woodfield last appeared in the pages of *Your Computer* as 1981 Micromouse Champion returning to defend his title at our 1982 Computer Fair. Unfortunately his Micromouse, "Thumper", after setting an "unofficial lap record" in practice mistook a piece of tape for a wall of the maze and failed to reach the centre.

"The "DPC" meanwhile needed a name of its own. After much debate it was decided to call it the "Samurai home computer". Although the general appearance and specification of the machine had been settled there were still details which needed sorting out. The keyboard was a particular problem.

A conventional typewriter keyboard with 69 individually sprung keyswitches would have pushed the price of the Samurai over the £200 mark yet Spectrum style rubber keys would not be good enough for word processing. The eventual solution was to use relatively cheap injection mouldings for the keys on top of a carefully designed rubber mat with a sprung section underneath each plastic key. Surprisingly this feels like a real keyboard.

The cartridge port was another difficult area. Hollington thought about slotting cartridges in on top or perhaps under a pop up plastic lid. In the end, fear of coffee being spilt into the machine led him to opt for a recessed port at the side.

By February 1983 the shape was settled and a model maker was commissioned to produce a wooden mock-up of the finished product, painted two-tone grey — dark at the back, light at the front — which was supposed to symbolise the difference between the heavy processing power of the micro and the friendly interface with the user.

Meanwhile the "DPC", now the Samurai, was about to change its name again. Although Madge says they had gone through "all the correct procedures — registering a trademark and so on" another company started using the name for computers.

In a desperate attempt to get in before they did Madge placed teaser adverts in April's *Your Computer* saying "The Samurai home computer is coming" but in the end decided to change the name — first provisionally to Oscar and then finally to Elan.

Technically the machine itself is called the Enterprise and it will be made in two versions, 64K for £200 and 128K for £300. "It is a model range" says Madge "just like the Ford Sierra".

Over a long Easter weekend Oakley produced drawings for the model maker to produce moulds for final production of the case. The model maker, "he understands shape" says Oakley, has to carve the form of the computer out of solid blocks of graphite which then go to the toolmakers.

The job was too big for any one toolmaker so Nick Oakley had to commute between seven different firms checking that the bits that each was producing would all fit together in the end and expecting disaster at any moment "I was living in a car, thinking when's it going to happen?".

Sure enough it did — the base component was nearly a quarter inch too long and it was too late to get the mould remade. Fortunately the toolmaker was able to shave a section out of the mould and the only sign that all is not quite as the designer intended in the finished machines is that one of the ridges on the base is slightly wider than the others.

"Learn the lessons of other people's mistakes"

As the workload increased Geoff Hollington and Nick Oakley delegated more of the technical jobs to Beverley Hobson. In all areas the team working on the Elan project increased in size until before the press launch there were 50 people working on it.

Elan brought in a graphic design consultant to advise on colours for the keys and the case. He advised against the two tone grey because it looked "too specialist" for a home computer. He picked out the eight programmable keys in blue, the Stop key in red, the main keyboard dark grey like the case, and other keys in green.

From the outside the Elan Enterprise looked

(continued on page 85)

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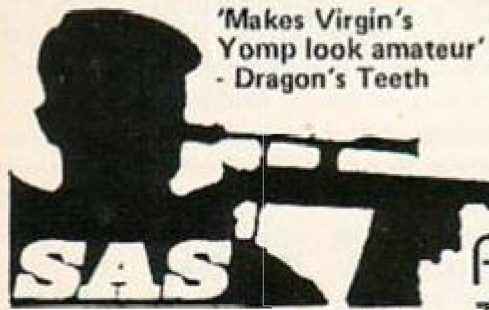
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SCOPE

(continued from page 81)
complete by the beginning of September and it was time for the press launch which went smoothly — apart from the crisis caused by the late arrival of the rubber membranes.

But although the case and the hardware inside were ready at the launch there was a limit to what could be demonstrated beyond the range of colours available on screen and how smoothly they could be scrolled. The Basic, which has taken two years to write to try to meet the specifications of the American National Standards Institute, was running on other machines but had not yet been implemented on the Elan.

"There is a shortage of design expertise"

It is more structured than most Basics and it also has a higher level of arithmetical accuracy. Again there has been a trade off between these advantages and speed. The Elan Basic will not be as fast as BBC Basic. On the other hand Elan expects to have Forth, Lisp and assembler available when the Enterprise is launched together with a clever piece of software which will convert programs for the BBC and Electron to run on the Elan.

At the moment Elan is trying to implement the Basic on the first few prototype machines. The peripherals which will be available by late Summer are being prepared also. The original idea of connecting the peripherals side by side next to the computer was rejected because by the time you had the expansion box and disc drives "you were off the end of the table."

Instead Hollington opted for a stacked hi-fi solution. The expansion box which should you ever need it can take up to 4 megabytes of RAM would act as a base unit with the twin 3.5 in. Sony disc-drives on top and further units — such as a Modem on top again.

One of the most difficult problems when you are designing a new computer is allowing for what machines other companies might release in the time between you sketching out your plans and finally producing a micro. It can take as little as nine months for a computer to move from the drawing board to the point of sale but a year is more common.

The specification of Acorn's Electron, for instance, was known in computing circles in April 1982 and *Your Computer* published an exclusive photograph of it in December 1982 yet it was August 1983 before the machine was launched and there are still production difficulties.

Robert Madge has been pleasantly surprised how few new computers have been launched in the 18 months since the Elan project started. "There is a shortage of design expertise".

Beverley Hobson, another of Hollington's team.



The Elan Enterprise appears to have met the original design criteria of being able to "play the best video games around yet still be respectable for education and home use" and the specification looks tremendous today yet no-one can predict what it will look like in April when it goes on sale.

Sinclair's long-awaited ZX-83 may be out by then and commodore has a new 64-style machine on the stocks called the 444.

The Japanese MSX machines could also be on sale by Spring and though none of them appear to match the Elan head on it will be a nailbiting few months for the Elan team. ■

DESIGN YOUR

HOWEVER GOOD your computer is there must be times when you wish it had a little more memory, a better keyboard or more flexible graphics. Well now is the chance to design the computer of your dreams.

You can take the competition as seriously or as lightly as you want. We are as interested in wax crayon sketches from eight-year olds as we are in fully-documented designs from teams with technical training. The decision tree with sample prices is only meant as a guide to some of the ideas you might want to build in to a micro.

If you add up all the costs of the components you would need and then add a few pounds for all the little pieces that would have cluttered up the tree you will have an approximate cost for your micro.

You will have to at least double this cost to get a realistic price for what your micro might cost in the shops if it went on sale in the middle of next year. The competition is split into three categories to give everyone the best possible chance.

Individual or Group

You can either enter as an individual — junior if you are under 14 on December 31, 1983 or Open if you are older — or you can enter as a Group.

Groups could be a class or computer club or just an informal team made up of your friends. The advantage of a group entry is that you can take advantage of individual skills much as a real computer design team would.

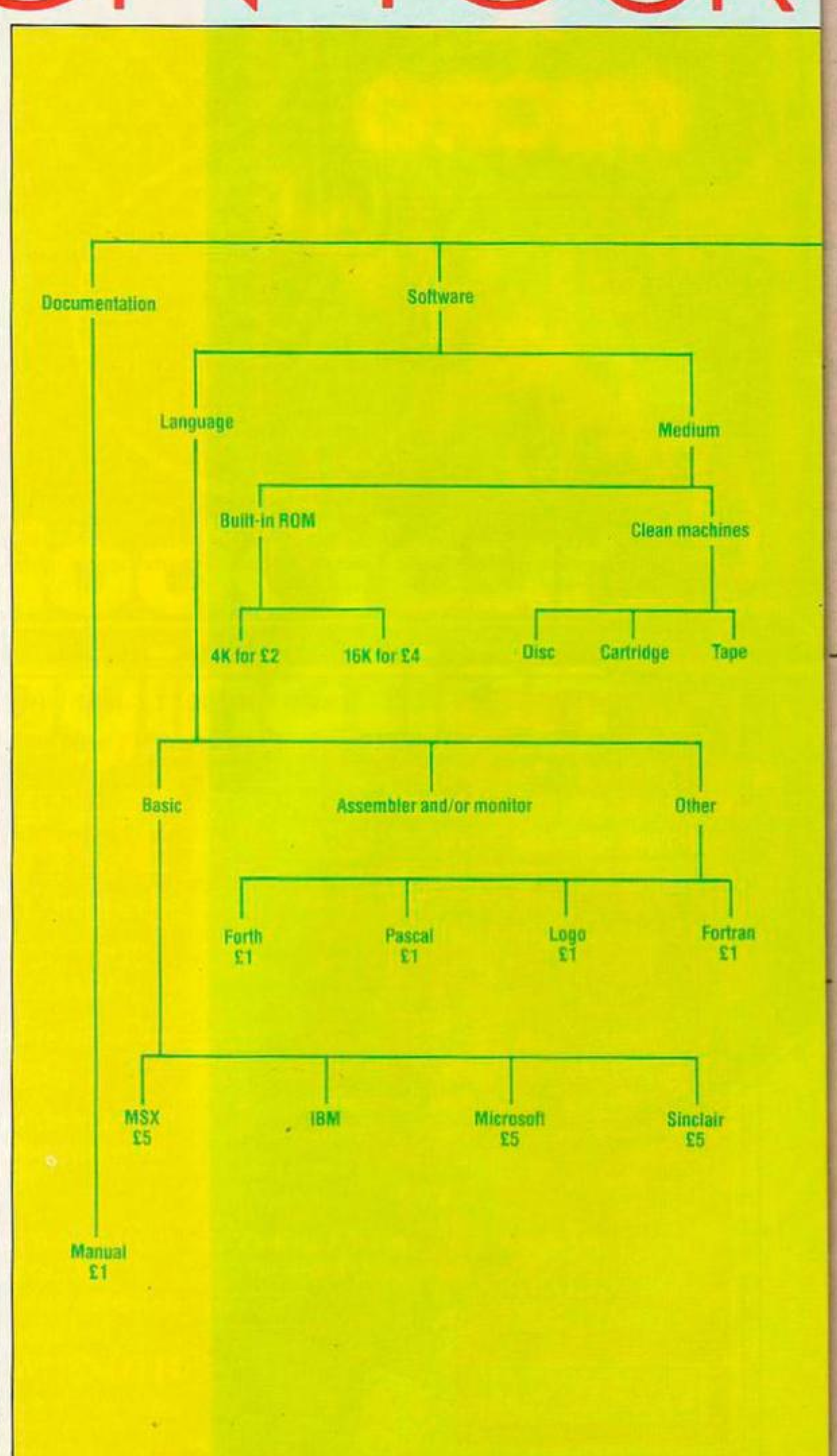
One person can concentrate on the external design of the machine while another looks at the Basic and built-in software and others choose which processors to go for, how much memory is required and what additional features to build in.

In addition to all the peripherals mentioned in the tree you might also want to build in others — a printer for instance.

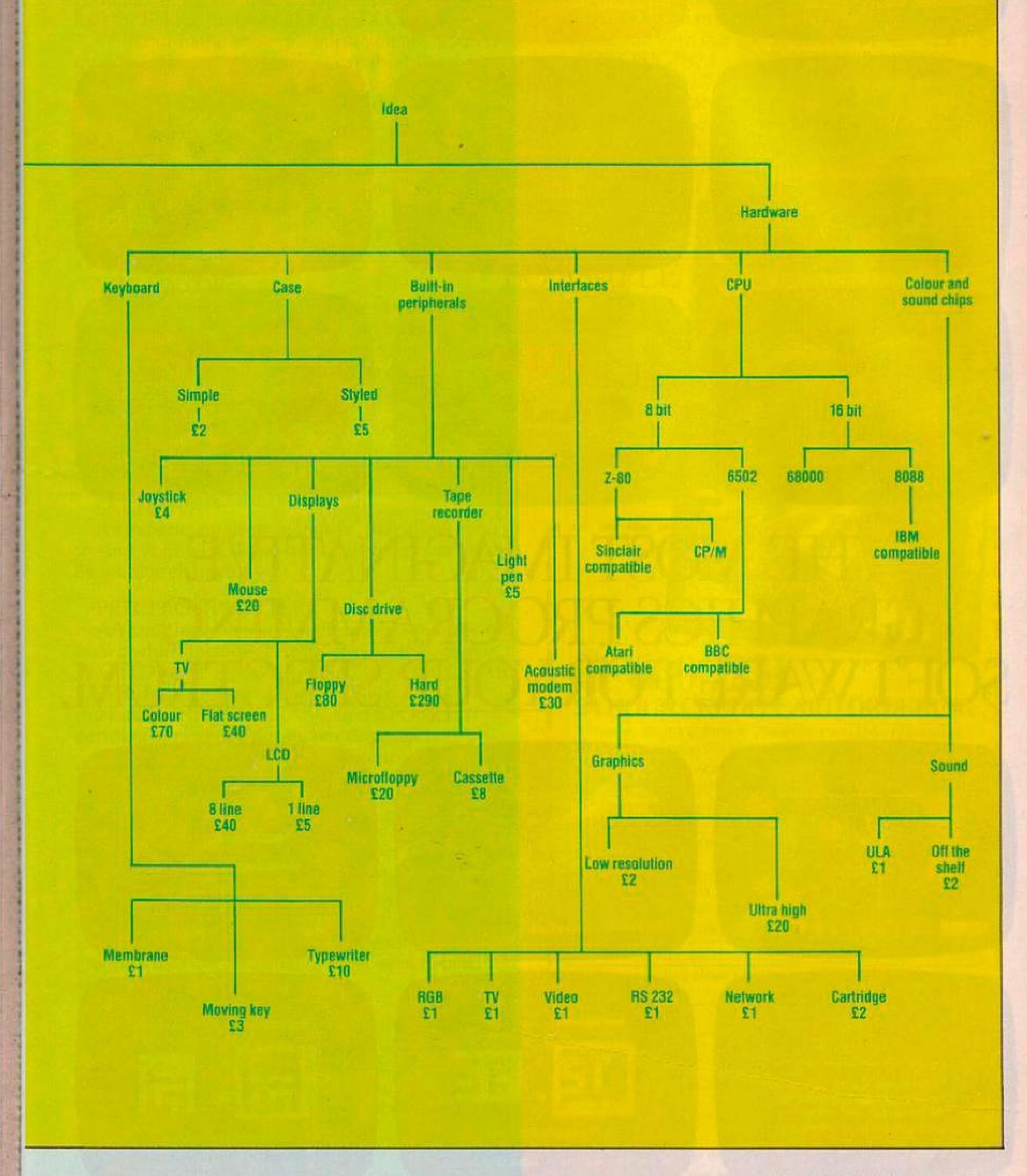
In terms of the costs quoted in the tree you should allow around £40 for a simple printer, £80 for a four colour min-Biro printer and £100 for an A4 plain paper printer. All these costs obviously double by the time you get to the shops.

If you want to go into more detail — say specifying a TMS — 9918 chip for graphics — we will be interested. You might want to give an outline of what you would like the Basic to be capable of or perhaps some other language you would want to build in.

The competition entries will be assessed by a team of experts who are well used to the difficult decisions that have to be taken when you are trying to build a successful microcomputer. Who knows some of you may go on from drawing up a sketch and a specification for this competition to becoming full-fledged computer designers in your own right.

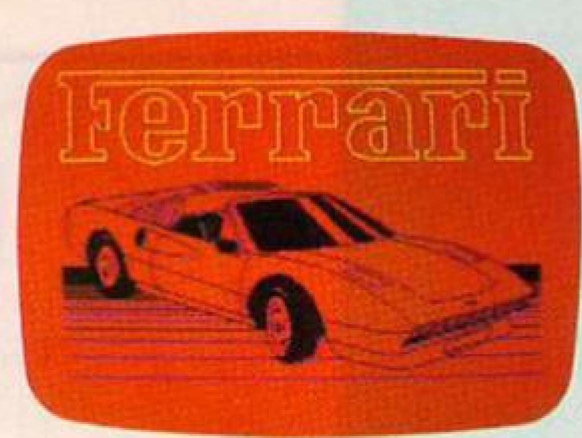


OWN MICRO



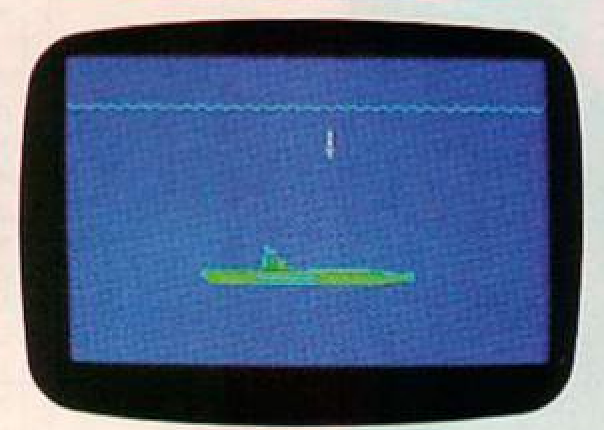
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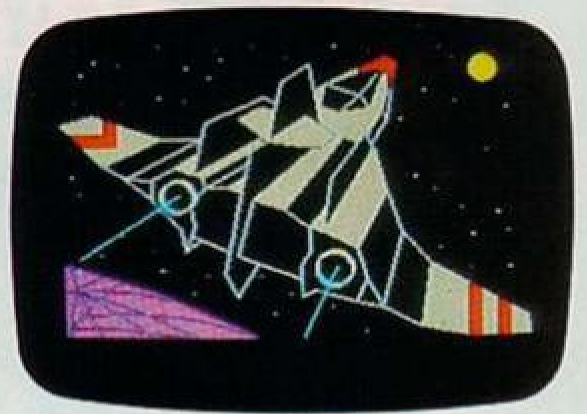


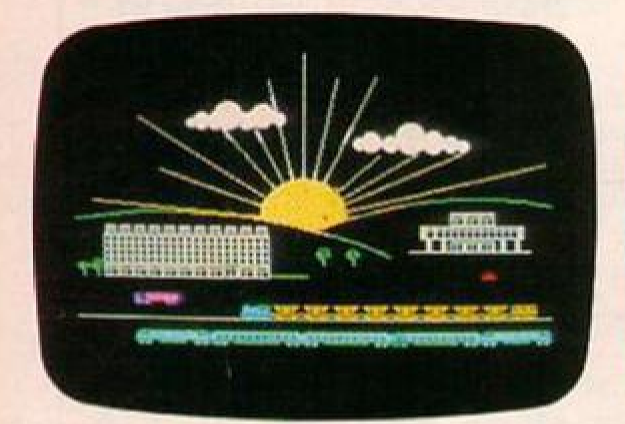
















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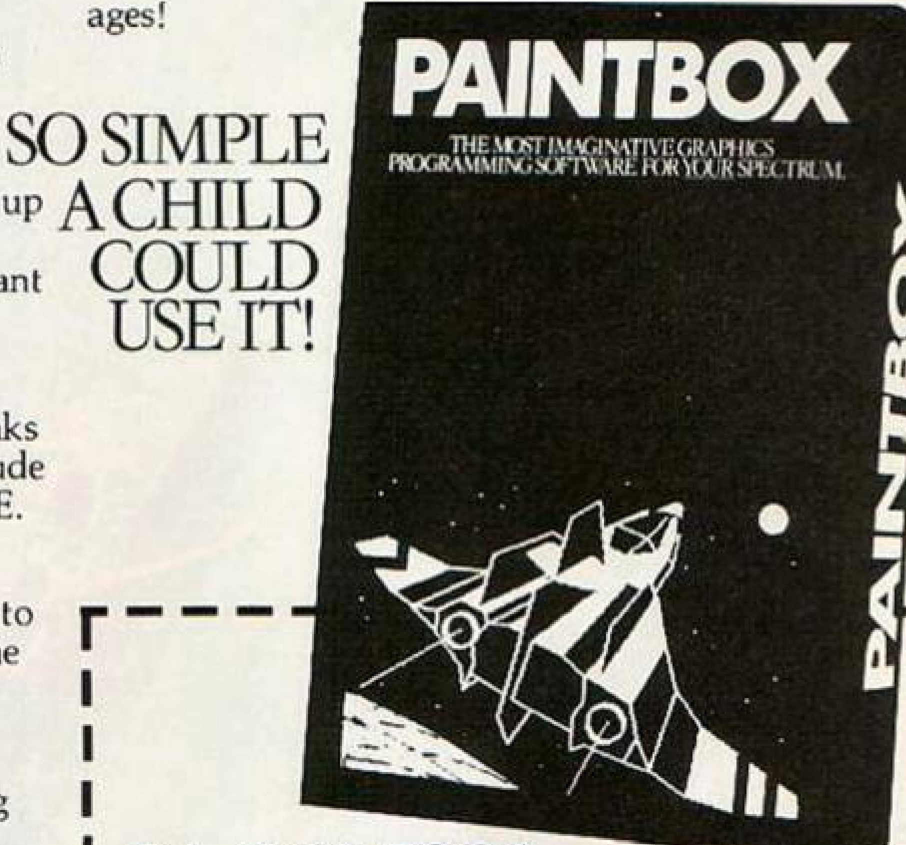
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THE MICROD

Kathleen Peel takes the lid off Sinclair's Microdrive and Interface 1.



NOW THAT INTERFACE 1's and Microdrives are beginning to reach users, it is becoming clear that more information on how to use them is required.

I will present a series of short guides on the various aspects of using the two new Sinclair products. The guides will take a simplistic view of each device in terms of hardware and software, trying to provide an overall understanding of operation and use of Sinclairs new Extended Basic.

Let us first take a simple view of the Interface. Fix it to the base of the Spectrum and all that has happened is that the keyboard slopes at a more convenient angle. You can not communicate with other equipment in a local area network, talk through the RS-232 interface or even Save or Load files to the Microdrives.

In order to do any of the above you need to make some hardware connections *and* tell the

DRIVE FILE

Figure 1. Colour screen dump program using the RS-232 Interface.

```
1000 FORMAT "b";600: REM full screen dum
p
1002 GO SUB 3000: REM Picture
1003 LET u=0
1010 OPEN #3;"b"
1020 LPRINT CHR$ (18)
1030 FOR y=175 TO 0 STEP -1
1040 FOR x=0 TO 255

1050 IF POINT (x,y)<>0 THEN  GO SUB 2000
: LPRINT "J1,0": GO TO 1070
1060 LPRINT "R1,0"
1070 NEXT x
1080 LPRINT "R-256,-1"
1090 NEXT y
1100 LPRINT "A"
1110 CLOSE #3: STOP
2000 REM Colour dump
2010 LET w=INT ((x+1)/8): LET v=INT ((17
6-y)/8)
2020 LET z=ATTR (v,w): LET a=256
2022 LET a=a/2: IF a<=4 THEN  GO TO 2028
2024 LET z=z-a: IF z>0 THEN  GO TO 2022
2025 LET u=z
2026 LET z=z+a: GO TO 2022
2028 IF z=u THEN  RETURN
2029 LET u=z
2030 IF z=1 THEN  LPRINT "C1": RETURN
2040 IF z=2 THEN  LPRINT "C3": RETURN
2050 IF z=4 THEN  LPRINT "C2": RETURN
2060 LPRINT "C0": RETURN
```

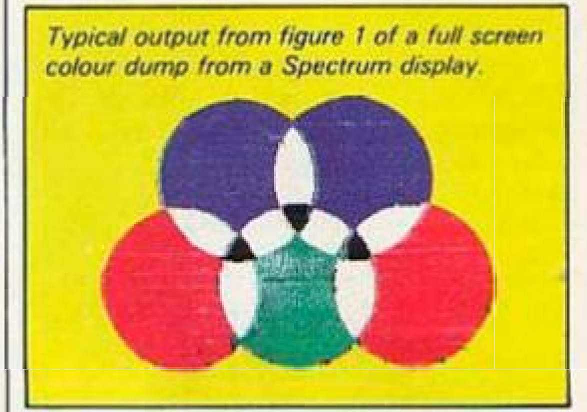
Figure 2. Control codes.

Control code	Function
7	Bell
8	Backspace
10	Linefeed
11	Reverse linefeed
12	Formfeed
13	Return
27	Escape mode
+14	Double width
+15	Single width

Figure 3. Printer connections.

Spectrum 9 way D-shell plug			
PIN 3	DATA		
PIN 4	DTR		
PIN 7	GND		
Printer 25 way D-shell plug			
PIN 3	DATA	(EP-22)	BROTHER
PIN 20	DTR		
PIN 7	GND		
Printer 4 Pin DIN plug			
PIN 4	DATA	(TP-10)	TANDY
PIN 2	DTR	(CGP-115)	
PIN 3	GND	(CGP-220)	
Printer 5 Pin DIN plug			
PIN 1	DATA	(GP-250)	SEIKOSHA
PIN 2	DTR		
PIN 3	GND		

Typical output from figure 1 of a full screen colour dump from a Spectrum display.



The program that produced the screen dump.

```
10 INK 0: PAPER 7:
BORDER 7: CLS
20 CIRCLE 128,54,50
22 CIRCLE 55,54,50
24 CIRCLE 200,54,50
26 CIRCLE 92,121,50
28 CIRCLE 164,121,50
29 PRINT *128,90,0
31 PRINT *164,120,1
32 PRINT *92,120,1
35 PRINT *46,80,2
50 PRINT *211,80,2
60 PRINT *92,84,0
65 PRINT *164,82,0
70 PRINT *128,50,4
```

computer how to pass the information to and from the communicating devices.

This is what you do every time you Load or Save a program onto tape, first making the ear or mic lead connection followed by either the command Save or Load and information as to whether the file is data or program.

Until you try and use one of the new Extended Basic commands, the Microdrive maps and network channel additional system variables are not created. This is the reason why virtually all the commercial software will run if loaded prior to using any of the Extended Basic commands.

Try listing the catalogue of drive 1 and then attempt to load the same software, quite a high proportion will not now run because the additional system variables created have moved the program up in memory, not a problem with Basic which works from line numbers but it will prevent machine code programs, which use RAM addresses relative to the first line of Basic i.e., machine code in Rem's from running.

Some programmers specifically used Rems for this reason as in the early Spectrum days nobody knew what if any limitations would be put on Microdrive file manipulations.

To employ the RS-232 interface, either use the Sinclair RS-232 lead to connect to equipment with the 25-way D type connector or make/buy a suitable interface lead for your

(continued on next page)

(continued on previous page)
peripheral.

Once the hardware connection has been made, the commands are simply:

```
FORMAT 't';baud rate
OPEN#3;'t'
```

This is the what and how required to tell the computer its next instruction. assuming that why is because it is the next instruction then:

Format defines the what we are going to transmit, the 't' in this instance means text and baud rate is the speed at which we are going to send the data.

The 't' — text — could be 'b' — binary — and represents the language of the data being sent and baud rate gives the speed of the data transmission. It is quite difficult to understand a 45 rpm record at 16 rpm, the computer has the same problem and needs to know not only what the type of data is but also the speed at which it is being sent.

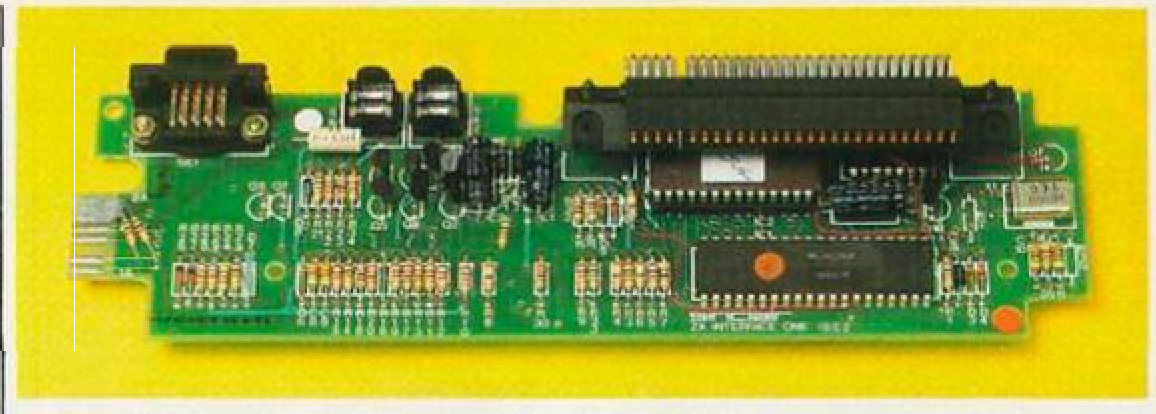
The Open command is the how and tells the computer the route being used to send the data. an analogy is perhaps the following:

POST	Letter	Stream # 4 - text
PIDGEON	Letter	Stream # 5 - text
PHONE	Data	Stream # 6 - binary

The Spectrum allows for 15 different streams, those above number three are user definable. The following meanings are associated with streams 0 to 3:

Stream 0	output lower tv and
Stream 1	input from keyboard
Stream 2	output to tv
Stream 3	output to ZX printer

To communicate with the Tandy CGP-115



requires the following:

```
CLOSE#3              initialise channle
FORMAT 't' ;600      text @ 600 baud
OPEN#3;'t'           ZX printer channel
```

Whatever would normally have gone to the ZX printer will now be sent via the RS-232 connection providing an LList and LPrint facility. Changing the 't' to a 'b' will change from text to binary transmission.

All this means is that instead of sending code 216 as CIRCLE — page 188, Spectrum manual — the ASCII code 216 will be sent to the printer, which in all probability will not be understood, but more importantly the control codes — those codes below 32 — can also be sent and some of these are extremely useful in formatting text.

To go from text to binary, close the stream to remove the old instruction and then re-open with the new instructions.

```
CLOSE# 3
FORMAT 'b';600
OPEN# 3;'b'
```

This will allow the passing of control information to the peripheral

```
LPRINT CHR$ (17);CHR$ (29)
```

will provide the command to change the pen colour on the CGP-115 printer. And to change back

```
CLOSE# 3
FORMAT 't';600
OPEN# 3;'t'
```

for more text.

A degree of standardisation exists among printers in the use of control codes. Figure 2 gives a list of the usual meaning of the more common controls.

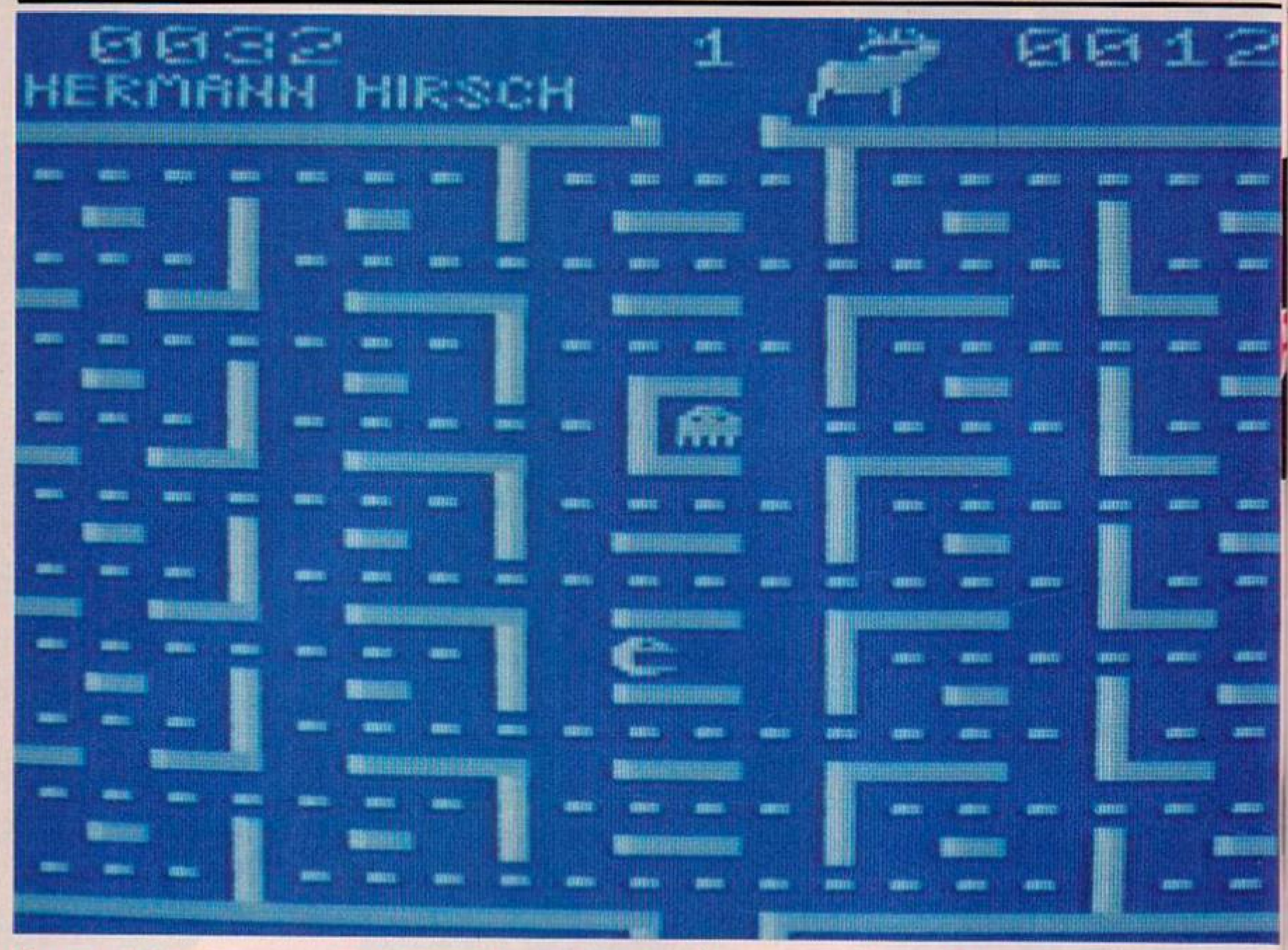
These may be used to manipulate the text and to provide graphics capabilities.

The program in figure 1 is a very, very slow colour screen dump program using the RS-232 Interface. It could be made a great deal faster by drawing each colour in turn rather than plotting each line sequentially as shown.

Some of the common RS-232 Interface connections are provided in figure 3. ■



Temptation
Software Limited
SINCLAIR ZX 81 16K
SPECTRUM 48K
BARON
by Simon Mansfield
Baron is a complex simulation game for up to four players
Step back in time when the country was divided into huge estates
Could you accept the responsibilities of a Barony? Farm your lands, maintain workers, hire mercenaries, wage feudal wars?
Yearly analysis of success or failure of your decisions.
There are unexpected events in store for you – to find out, why not play the game?
Graphics
SINCLAIR ZX 81 16K
SPECTRUM 48K
ADMIRAL GRAF SPEE
by Simon Mansfield
An original game of strategy based on historically accurate records of the Graf Spee's formidable presence in the North and South Atlantic
As her Captain use full graphic instrumentation to calculate speed, compass bearings, fuel, distance, ammunition states; locate and manoeuvre into visual range and destroy enemy ships which can also evade, seek and destroy you! Attacked targets can only be destroyed by the same number of salvos or torpedoes as were necessary for the tonnage during the original action.
7 levels of difficulty
SINCLAIR ZX 81 16K
SPECTRUM 48K
DUNGEONS OF DOOM
by Simon Mansfield
Two challenging adventure games – to travel through the labyrinths, descending to the lowest dungeons where the treasures are hidden or play "ESCAPE FROM THE UNDERWORLD" and save yourself from incarceration in the dungeons by fighting you way up the endless levels.
Graphics show your position – status reports – different layout with each new game – 4 players can search different levels – 400 rooms – 600 corridors – 1000 locations to explore
Objective – to score highest points and STAY ALIVE
SPECTRUM 16K
LAS VEGAS
by Neil Streeter
A Temptation games double
1. FRUIT MACHINE – must be the best full feature "Pub" Fruit Machine. Spin the symbols, use the "nudge" "hold" "gamble" facility – win or lose with true percentage payouts.
2. BLACK JACK – break the bank with a five card trick. This game follows the rules of Pontoon. The Spectrum croupier deals the cards with skill and is after your stake money!
Superb graphics
SPECTRUM 16K
CHALLENGE
by Neil Streeter
A Temptation games double
1. MASTER CODE DELUXE – all the features of the well known game. 5 skill levels – any code or no repeated colours. Good clear graphics show the success or failure of your logic as the computer assesses each line.
2. HIGHER AND LOWER – skill, hunches and sixth sense are needed to beat this fast dealing machine. Graphically as realistic as a certain television series. Will you be able to get to the end of the row of five cards, guessing whether the next card will be HIGHER or LOWER?
SPECTRUM 16K
GODZILLA AND THE MARTIANS
by Neil Streeter
The Martians have invaded, destroying the molecular structure of earth's atmosphere to make it compatible with their own planet.
"The girl of your dreams" is trapped at the top of a building site but for the moment protected from the evil invaders by a friendly Dinosaur-Leap over deadly Martian invaders – scale ladders – jump the man traps – rescue her before the oxygen is totally absorbed.
Kong type game for SUPERHUMANS
NEW
The 3 fastest playable 100% machine code arcade games for the VIC 20 unexp
ARCADE
VIC 20 unexp
SWARM
by Andrew Haisley
As a pilot testing the latest star ship, breakdown in your guidance systems causes you to materialise in the breeding grounds of the Psigophorus, an unbelievably nasty insect life form which kills anything entering its space. Survival depends on destruction of the eggs before they hatch to form a SWARM. They can use your laser energy to mutate at an alarming rate and the only escape from the devastating attack of a Swarm is by destroying the Psigophorus in only one brief stage of its life cycle.
CAN YOU SURVIVE this high scoring game?
ARCADE
VIC 20 unexp
ALIEN VORTEX
by Andrew Haisley
It is the 23rd Century – unemployment 99.9% – due to 500% inflation, money replaced by credit discs – to relieve boredom the I.R.S.P. sets up huge gambling arcades – debts run high – inhabitants who cannot pay take part in "THE GAME". Transported to Launch Base 3 they are sealed into a Zelton Earth Defender and attacked by waves of mutant birds, specially bred on the Space Station Alien. Moneylenders bet on the length of the ill-fated player's survival, so recovering their losses.
SET your body modulator to HYPERDRIVE: PRIME your firing fingers and HANG LOOSE.
High scoring game
ARCADE
VIC 20 unexp
THUNDERFLASH
by Andrew Haisley
The year 2500 A.D. has produced a problem: space Rats are using humanoids for experimentation! Their technical skills include impenetrable defence systems. A Royal Space Fleet Pilot sent to destroy them has been killed. YOU ARE INVITED TO TAKE HIS PLACE.
You will be bombarded by zig zagging steel arrows – if not destroyed they turn into Thunderflashes which explode when hit. Being unstable they release sparks which you must destroy before they hit you. Your survival angers the Rats who increase the speed and fury of the attack.
High scoring game
VIC 20 16K
DRAGON 32K
MICROPOLY
by Richard Fry & Simon Lacey
Play this version of the family board game with a competent and challenging microbanker and property tycoon. State of game and board on instant recall – or the game saved.
Game for up to four players AND the computer
VIC 20 Unexp
COBUS MAZ
by Dave Gibson
A series of ridiculously impossible layouts which our self-destructing Programmer has devised for VICtims! Just get from "A" to "B" without being blown up or eaten by a COBUS – simple? You are given five lives and five ZOGS to hyperspace a COBUS when you are cornered. Successful exit brings the reward of greater challenge with progressively difficult layouts and hidden complications. Keys require collecting in a correct order to open the door, devilish invisible mines and
TI 99/4A Ext. Basic
HOUSE OF BUGS
by Tony Frampton
The Bugs in this game will raise your blood pressure to the limits and drive spectators into a frenzy!
In this high scoring game killer bugs roam the top floors. Stay alive by clinging to the ceiling whilst they pass beneath, but you cannot seek refuge on that square again. BUNGE a Bug and gain 50 points, but he may return for his revenge – a glorious ritual followed by your paralysis and death!
WATCH the Bugs go hopping mad when target scores give you the services of a Bladeer.
Fantastic graphics and sound
TI 99/4A Ext. Basic
TANK BATTLE
by Tony Frampton
Can you hold back a relentless army of tanks, sometimes in convoy but often slipping in under the cover of their barrage of gunfire as they try to penetrate your arm tank barriers? Manoeuvre your tank controlling its gun barrel for accurate range. WATCH your salvos disintegrate the enemy BUT BEWARE the deadly return fire.
Realistic graphics and sound. Five skill levels – strategy to desperation
TI 99/4A Ext. Basic
SPECIAL MISSION
by Tony Frampton
TOP SECRET – save the world from destruction – HOW? WHY? WHEN?
Your mission starts in a large briefing room, there is a door to the East. You can see a blood stained envelope and a cold strong box, you are carrying nothing at all! TIME is running out the robots have been activated – WHAT ARE YOU GOING TO DO?
Only a T.I. trained special adventure agent has a chance of saving millions from annihilation
NEW
DRAGON 32K
SEARCHWORD
by Ian A. Macey
A WORD PUZZLER'S PARADISE!
CREATE your own word puzzles by the thousand.
An irresistible game for word puzzle enthusiasts, this program offers endless permutations. The computer will accept any list of words containing from 3 to 12 letters and conceal them within a letter grid until the player identifies them by giving the correct start position co-ordinates and direction. Program also includes two demonstration files and word save facility. Hours of enjoyment for one or more players
To: Temptation Software Ltd.,
27 Cinque Ports St.,
Rye, E. Sussex.
GAMES
£5.95
1st Class
postage and packing
and our unique lifetime
replacement guarantee
Overseas add £1.00
to each Game
Dealer/Trade enquries
& New programmes welcomed
phone Dave Clements
(07974) 2225
Name
Address
Postcode
Game
Computer
I enclose cheque. p.o. for £



VICMAN

Herman Hirsch presents a fast and very difficult to play version of that old arcade favourite, Pac-Man, for the Vic 20.

SOME MONTHS ago I saw the program Pac-Man on an Atari games-computer. So if got the idea of writing a similar program on the Vic-20. The result is a simpler game than the original one but I think it is still rather good. To run the program you need a Vic-20 with at least 8K expansion and a joystick.

The Vicman, directed by the player, eats the biscuits he will find on his way. He has a hard life because three monsters are chasing him.

One player has three Vicmen for one game. It is however, possible to get one or more extra Vicmen if all biscuits are eaten.

The number of biscuits the Vicman has eaten is shown at the top left. On the top right the high score will be displayed. On the middle of the top- and the bottom line there are holes to escape. When the Vicman goes out, the monsters will no longer move, but wait until he comes back.

There is a sum-function integrated in the

Machine code program.

1200	00	0B	12	0A	00	9E	34	36
1208	35	36	00	00	00	97	34	30
1210	39	36	AA	49	2C	30	3A	82
1218	00	23	12	14	00	9E	34	36
1220	30	30	00	00	00	00	00	00
1228	00	00	00	00	00	00	00	00
1230	A0	2C	09	00	21	99	00	10
1238	00	10	F7	4C	50	12	00	00
1240	C6	02	D0	05	A9	00	8D	0A
1248	90	4C	BF	EA	31	C3	30	C7
1250	A9	00	85	C1	85	C2	A9	03
1258	85	01	A9	0E	85	0A	85	01
1260	A9	0A	85	AA	A9	0F	85	A8
1268	A9	54	85	A3	A9	11	85	A4
1270	A9	00	85	A8	85	A9	85	AD
1278	8D	10	12	8D	19	12	8D	1E
1280	12	8D	28	12	8D	29	12	8D
1288	2E	12	8D	30	12	8D	39	12
1290	8D	3E	12	85	AC	A9	10	8D
1298	1C	12	A9	20	8D	2C	12	A9

12A0	30	8D	3C	12	A9	10	85	09
12A8	A9	01	8D	13	12	8D	23	12
12B0	8D	33	12	A9	18	8D	14	12
12B8	8D	24	12	8D	34	12	A9	00
12C0	8D	1A	12	8D	2A	12	8D	3A
12C8	12	A9	09	8D	1B	12	8D	2B
12D0	12	8D	3B	12	A9	00	85	00
12D8	A5	01	09	30	8D	00	10	78
12E0	A9	40	8D	14	03	A9	12	8D
12E8	15	03	58	A0	2C	89	00	21
12F0	99	00	10	A9	01	99	00	94
12F8	C8	D0	F2	99	00	22	99	00
1300	11	A9	01	99	00	95	C8	D0
1308	F2	A9	6E	A0	00	99	0F	90
1310	A6	CD	99	05	90	A9	06	8D
1318	37	94	8D	EF	95	A5	01	85
1320	30	8D	00	10	A0	2C	A9	01
1328	99	00	94	88	D0	FA	A9	6E
1330	8D	17	12	8D	27	12	8D	37
1338	12	A9	00	85	10	85	1C	85
1340	1D	4C	38	1D	82	CD	35	C8
1348	32	CA	8D	C7	3A	C1	30	C4

1350	A9	FF	85	FE	A9	CF	8D	0E
1358	90	A9	00	85	FF	20	EC	20
1360	A9	D8	8D	00	90	A9	00	20
1368	EC	20	A9	01	8D	00	90	A9
1370	00	85	FF	20	EC	20	A0	03
1378	A9	07	8D	00	90	A9	90	85
1380	FF	4C	AA	13	A9	00	8D	00
1388	90	60	A9	FA	85	FD	8D	0E
1390	90	A9	FF	85	FE	A5	FC	85
1398	FF	20	EC	20	C6	FD	A5	FD
13A0	C9	AA	D0	EA	A9	00	8D	0E
13A8	90	60	20	EC	20	A5	00	8D
13B0	00	90	A9	90	85	FF	20	EC
13B8	20	00	D0	BC	60	BC	17	C1
13C0	20	20	20	20	20	20	20	20
13C8	20	20	20	20	20	20	12	05
13D0	01	04	19	2E	20	20	20	20
13D8	20	20	20	20	20	20	20	20
13E0	20	20	20	20	20	20	20	20
13E8	20	20	20	20	20	20	20	20
13F0	20	20	20	20	20	20	20	20
13F8	20	20	42	82	8C	10	00	10

1400	00	00	00	00	00	00	00	00
1408	3C	7E	DB	FF	FF	FF	AA	AA
1410	3C	7E	DB	FF	FF	FF	55	55
1418	00	00	00	3C	3C	00	00	00
1420	78	24	22	22	22	24	78	00
1428	7E	40	40	78	40	40	7E	00
1430	7E	40	40	78	40	40	40	00
1438	1C	22	40	4E	42	22	1C	00
1440	42	42	42	7E	42	42	42	00
1448	1C	08	08	08	08	08	1C	00
1450	0E	04	04	04	04	44	38	00
1458	42	44	48	70	48	44	42	00
1460	40	40	40	40	40	40	7E	00
1468	42	66	5A	5A	42	42	42	00
1470	42	62	52	4A	46	42	42	00
1478	18	24	42	42	42	24	18	00
1480	7C	42	42	7C	40	40	40	00
1488	18	24	42	42	4A	24	1A	00
1490	7C	42	42	7C	48	44	42	00
1498	3C	42	40	3C	02	42	3C	00
14A0	3E	08	08	08	08	08	08	00
14A8	42	42	42	42	42	42	3C	00

simple monitor that generates a checksum between two addresses.

Function C is for entering the code. You give the start-address and then the corresponding byte is displayed. Now you can either change the byte by typing the new hex number or increment the address by pressing F7 or decrement by pressing F1. In the last two cases, the contents of memory is displayed and will not be changed. By pressing Return you can give a new start address. Pressing any other key except those between 0 and F and those, just described, you return to the mini menue.

If everything has gone in the right way you will have a stand-alone machine-code program, which can be loaded and started like a Basic program. No Peeks and Pokes, before running.

You should type in the simple monitor, even if you have a better one because the checksums are generated with this program.Using a complete monitor with Save and Load routine you only must know the start address of 1200 hex for the machine program. The following points are only important for those people who want to use my simple monitor.

Type in direct mode, after powering on your Vic;

POKE 642,35:SYS64824.

Load 'simple monitor' and run it.

Function 'C' startadr. 1200 — later your last entered plus 1 — enter machine code as much as you can.'

Stop the monitor program, type in direct mode

POKE 44,18:POKE 46,35: POKE 45,0:
POKE 43,1: SAVE "VICMAN"

If you want to come back to the game later switch on your Vic; load "Vicman"; type in direct mode: POKE 642,35:SYS 64824; Load "simple monitor"; enter code starting at the last address plus 1. Type in as much as you can again; Stop the monitor; Type in direct mode:

POKE 44,18:POKE46,35:POKE 45,0:POKE 43,1:
SAVE "VICMAN".

When all the code is typed in do not forget to control the checksums before starting the program. Before you can run the program the first time you must Save it, because it is not restartable.

14B0	42	42	42	24	24	18	18	00
14B8	42	42	42	5A	5A	66	42	00
14C0	42	42	24	18	24	42	42	00
14C8	22	22	22	1C	08	08	08	00
14D0	7E	02	04	18	20	40	7E	00
14D8	3C	3C	3C	3C	3C	3C	3C	3C
14E0	00	00	FF	FF	FF	FF	00	00
14E8	00	00	3F	3F	3F	3F	3C	3C
14F0	00	00	FC	FC	FC	FC	3C	3C
14F8	3C	3C	3F	3F	3F	3F	00	00
1500	00	00	00	00	00	00	00	00
1508	3C	3C	FC	FC	FC	FC	00	00
1510	3C	3C	FF	FF	FF	FF	3C	3C
1518	00	00	00	3C	3C	00	00	00
1520	3C	3C	3F	3F	3F	3F	3C	3C
1528	3C	3C	FC	FC	FC	FC	3C	3C
1530	3C	3C	FF	FF	FF	FF	00	00
1538	00	00	FF	FF	FF	FF	3C	3C
1540	3C	7E	FF	F0	F0	FF	7E	3C
1548	03	06	0F	0F	0F	0F	07	03
1550	3C	6C	FF	0F	0F	FF	7E	3C
1558	C0	E0	F0	F0	F0	F0	E0	C0
1560	00	00	00	00	3C	7E	FF	FF
1568	FF	FF	7E	3C	00	00	00	00
1570	00	00	00	00	00	18	18	00
1578	00	02	04	08	10	20	40	00
1580	3C	42	46	5A	62	42	3C	00
1588	08	18	28	08	08	08	3E	00
1590	3C	42	02	0C	30	40	7E	00
1598	3C	42	02	1C	02	42	3C	00
15A0	04	0C	14	24	7E	04	04	00
15A8	7E	40	78	04	02	44	38	00
15B0	1C	20	40	7C	42	42	3C	00
15B8	7E	42	04	08	10	10	10	00
15C0	3C	42	42	3C	42	42	3C	00
15C8	3C	42	42	3E	02	04	38	00
15D0	00	00	00	00	00	00	00	00
15D8	00	00	00	00	00	00	00	18
15E0	0C	18	30	60	30	18	0C	00
15E8	00	00	7E	00	7E	00	00	00
15F0	70	18	0C	06	0C	18	70	00
15F8	3C	42	02	0C	10	00	10	00
1600	00	4A	4A	7A	4A	4A	4A	00
1608	00	E3	94	E2	C1	A4	93	00
1610	00	19	A5	21	21	A5	19	00
1618	00	20	20	E0	20	20	20	00
1620	00	40	4A	70	4A	4A	48	00
1628	00	DC	12	DC	10	14	D2	00
1630	00	51	AA	00	8A	8A	8A	00
1638	00	82	52	DA	56	52	52	00
1640	00	90	90	D0	B0	90	90	00
1648	01	00	01	02	00	01	3F	7F
1650	28	A4	FF	87	1F	FE	FC	FC
1658	7F	7F	7F	5F	C0	00	00	00
1660	F0	F0	E0	A0	20	20	20	20
1668	00	40	20	10	08	04	02	01
1670	01	02	04	08	10	20	40	80
1678	FF	00	00	00	00	00	00	00
1680	FF	01	01	01	01	01	01	01
1688	00	3C	7E	7E	7E	7E	3C	00
1690	00	00	00	00	00	00	FF	00
1698	36	7F	7F	7F	3E	1C	08	00
16A0	48	48	48	48	48	48	48	48
16A8	00	00	00	00	03	04	08	08
16B0	81	42	24	18	18	24	42	81
16B8	00	3C	42	42	42	42	3C	00
16C0	00	1C	2A	77	2A	08	08	00
16C8	02	02	02	02	02	02	02	02
16D0	08	1C	3E	7F	3E	1C	08	00
16D8	00	00	00	00	FF	00	00	00
16E0	A0	50	A0	50	A0	50	A0	50
16E8	00	00	00	00	00	00	00	00
16F0	00	00	01	3E	54	14	14	00
16F8	FF	7F	3F	1F	0F	07	03	01
1700	3C	7E	DB	FF	FF	FF	AA	AA
1708	1E	3F	6D	7F	7F	7F	2A	2A

1710	00	00	00	00	00	00	00	00
1718	0F	1F	36	3F	3F	3F	2A	2A
1720	00	00	C0	C0	C0	C0	80	80
1728	07	0F	1B	1F	1F	1F	0A	0A
1730	00	C0	60	E0	E0	E0	A0	A0
1738	03	07	0D	0F	0F	0F	0A	0A
1740	C0	E0	B0	F0	F0	F0	A0	A0
1748	01	03	06	07	07	07	02	02
1750	E0	F0	D8	F8	F8	F8	A8	A8
1758	00	01	03	03	03	03	02	02
1760	F0	F8	6C	FC	FC	FC	A8	A8
1768	00	00	01	01	01	01	00	00
1770	78	FC	B6	FE	FE	FE	AA	AA
1778	00	00	00	00	00	00	FF	FF
1780	3C	7E	DB	FF	FF	FF	AA	AA
1788	7E	DB	FF	FF	FF	55	55	00
1790	00	00	00	00	00	00	00	3C
1798	DB	FF	FF	FF	AA	AA	00	00
17A0	00	00	00	00	00	00	3C	7E
17A8	FF	FF	FF	55	55	00	00	00
17B0	00	00	00	00	00	3C	7E	DB
17B8	FF	FF	AA	AA	00	00	00	00
17C0	00	00	00	00	3C	7E	DB	FF
17C8	FF	55	55	00	00	00	00	00
17D0	00	00	00	3C	7E	DB	FF	FF
17D8	AA	AA	00	00	00	00	00	00
17E0	00	00	3C	7E	DB	FF	FF	FF
17E8	55	00	00	00	00	00	00	00
17F0	00	3C	7E	DB	FF	FF	FF	05
17F8	F0	F8	F8	F0	0F	0F	0F	0F
1800	3C	7E	FF	C0	E0	E0	7F	3C
1808	1E	3B	7F	70	78	70	3F	1E
1810	00	00	00	00	00	00	00	00
1818	0F	1D	3F	3C	3C	3F	1F	0F
1820	00	00	C0	00	00	C0	80	00
1828	07	0E	1F	1F	1F	1F	0F	07
1830	80	C0	E0	00	00	E0	C0	80
1838	03	07	0F	0F	0F	0F	07	03
1840	C0	E0	F0	C0	C0	F0	E0	C0
1848	01	03	07	07	07	07	03	01
1850	E0	F0	F8	C0	C0	F8	F0	E0
1858	00	01	03	03	03	03	01	00
1860	F0	D8	FC	C0	C0	FC	F8	F0
1868	00	00	01	01	01	01	00	00
1870	78	EC	FE	C0	C0	C0	FE	78
1878	00	7F	7F	7F	7F	7F	7F	7F
1880	3C	6E	FF	07	07	07	FE	3C
1888	1E	37	7F	03	03	03	7F	1E
1890	00	00	00	00	00	00	00	00
1898	0F	1B	3F	03	03	3F	1F	0F
18A0	00	80	C0	C0	C0	C0	80	00
18A8	07	0D	1F	03	03	1F	0F	07
18B0	80	C0	E0	E0	E0	E0	C0	80
18B8	03	06	0F	03	03	0F	07	03
18C0	C0	E0	F0	F0	F0	F0	E0	C0
18C8	01	03	07	00	00	07	03	01
18D0	E0	70	F8	F8	F8	F8	F0	E0
18D8	00	01	03	00	00	03	01	00
18E0	F0	B0	FC	3C	3C	FC	F8	F0
18E8	00	00	01	00	00	00	01	00
18F0	78	DC	FE	0E	0E	0E	FC	78
18F8	00	00	C0	E0	F0	F0	FC	FE
1900	3C	6E	FF	07	07	07	FE	3C
1908	6E	FF	07	07	07	FC	3C	00
1910	00	00	00	00	00	00	00	3C
1918	FF	0F	0F	FF	7E	3C	00	00
1920	00	00	00	00	00	00	3C	6E
1928	1F	1F	FF	7E	3C	00	00	00
1930	00	00	00	00	00	3C	6E	FF
1938	3F	FF	7E	3C	00	00	00	00
1940	00	00	00	00	3C	6E	FF	3F
1948	FF	7E	3C	00	00	00	00	00
1950	00	00	00	3C	6E	FF	1F	1F
1958	7E	3C	00	00	00	00	00	00
1960	00	00	3C	6E	FF	0F	0F	FF
1968	3C	00	00	00	00	00	00	00

1970	00	3C	6E	FF	07	07	07	FE
1978	FF	FF	FF	FF	FF	FF	00	00
1980	D8	A5	A9	F0	03	4C	30	1D
1988	A0	00	A6	A8	D0	3E	18	A5
1990	A3	69	01	85	A5	A5	A4	69
1998	00	85	A6	20	38	1C	E0	0C
19A0	F0	11	E0	8A	85	A7	91	A3
19A8	E0	8A	85	A7	91	A5	86	A0
19B0	4C	38	1D	A2	00	86	A8	A5
19B8	A7	91	A5	A5	A0	91	A3	A5
19C0	A5	85	A3	A5	A6	85	A4	E6
19C8	AA	4C	38	1D	A5	A4	C5	A6
19D0	30	CC	A5	A3	C5	A5	30	C6
19D8	E9	E8	0C	18	18	8A	65	A7
19E0	91	A5	E8	8A	85	A7	91	A3
19E8	86	A0	4C	38	1D	A2	00	86
19F0	A0	A5	A7	91	A3	A5	A0	91
19F8	A5	4C	38	1D	D0	A5	A9	F0
1A00	03	4C	30	1D	A0	00	A6	A0
1A08	D0	46	38	A5	A3	E9	01	85
1A10	A5	A5	A4	85	A6	86	02	C6
1A18	A6	A2	18	20	38	1C	EA	CA
1A20	CA	CA	CA	E0	01	30	18	8A
1A28	85	A7	91	A5	E0	8A	65	A7
1A30	91	A3	86	A0	4C	38	1D	A2
1A38	00	86	A0	A5	A7	91	A5	A5
1A40	A0	91	A3	A5	A5	85	A3	A5
1A48	A6	85	A4	C6	AA	4C	38	1D
1A50	A5	A6	C5	A4	30	CA	A5	A5
1A58	C5	A3	30	C4	CA	CA	CA	E8
1A60	01	38	18	8A	65	A7	91	A3
1A68	E0	8A	65	A7	91	A5	86	A0
1A70	4C	38	1D	A2	00	86	A0	A5
1A78	A7	91	A3	A5	A0	91	A5	4C
1A80	38	1D	00	00	D8	A5	A8	F0
1A88	03	4C	30	1D	A0	00	A6	A9
1A90	D0	3E	38	A5	A3	E9	16	85
1A98	A5	A5	A4	E9	00	85	A6	20
1AA0	38	1C	E0	0C	F0	11	E0	8A
1AA8	85	A7	91	A3	E0	8A	85	A7
1AB0	91	A5	86	A0	4C	38	1D	A2
1AB8	00	86	A0	A5	A7	91	A5	A5
1AC0	A0	91	A3	A5	A5	85	A3	A5
1AC8	A6	85	A4	C6	AA	4C	38	1D
1AD0	A5	A6	C5	A4	30	CC	A5	A5
1AD8	C5	A3	30	C6	E0	E0	0E	18
1AE0	18	8A	65	A7	91	A5	E0	8A
1AE8	65	A7	91	A3	86	A0	4C	38
1AF0	1D	A2	00	86	A0	A5	A7	91
1AF8	A3	A5	A0	91	A5	4C	38	1D
1B00	00	00	D0	A5	A8	F0	03	4C
1B08	30	1D	A0	00	A6	A9	D0	46
1B10	18	A5	A3	E9	16	85	A5	A5
1B18	A4	69	00	85	A6	EA	EA	A2
1B20	18	20	30	1C	EA	EA	CA	CA
1B28	CA	E0	01	30	18	8A	65	A7
1B30	91	A5	E8	8A	65	A7	91	A3
1B38	86	A0	4C	38	1D	A2	00	86
1B40	A0	A5	A7	91	A5	A5	A0	91
1B48	A3	A5	A5	85	A3	A5	A6	85
1B50	A4	E6	A8	4C	38	1D	A5	A4
1B58	C5	A6	30	CA	A5	A3	C5	A5
1B60	30	C4	CA	CA	CA	E0	01	30
1B68	18	8A	65	A7	91	A3	E8	8A
1B70	65	A7	91	A5	86	A0	4C	38
1B78	1D	A2	00	86	A0	A5	A7	91
1B80	A3	A5	A0	91	A5	4C	38	1D
1B88	00	00	00	00	00	00	00	00
1B90	00	00	00	00	00	00	00	00
1B98	00	00	00	00	00	00	00	00
1BA0	A0	00	A2	00	B9	03	12	95
1BA8	A3	E8	EC	F0	04	E0	C8	10
1BB0	F3	A5	00	29	00	D0	0D	A5
1BB8	00	85	00	85	00	A9	00	85
1BC0	A7	4C	08	19	A5	00	29	10
1BC8	D0	0D	A5	00	09	10	85	00

1BD0	A9	90	85	A7	4C	FC	19	A5
1BD8	00	29	04	D0	0D	A5	00	09
1BE0	04	85	00	A5	A8	85	A7	4C
1BE8	84	1A	A5	00	29	80	D0	0D
1BF0	A5	00	09	80	85	00	A9	A0
1BF8	85	A7	4C	02	1B	A5	00	EA
1C00	EA	EA	EA	EA	EA	EA	EA	EA
1C08	EA	EA	EA	EA	A9	00	8D	13
1C10	91	A9	7F	8D	22	91	AD	11
1C18	91	29	7F	48	AD	20	91	29
1C20	80	05	00	60	85	00	05	00
1C28	4C	30	1D	00	8E	F5	F5	F5
1C30	A0	00	A5	A7	38	27	81	A5
1C38	30	78	C0	04	1A	12	48	A5
1C40	AC	4A	4A	4A	4A	A8	B1	1A
1C48	85	AD	68	91	1A	A0	00	60
1C50	8A	E0	E0	0A	C9	7F	18	50
1C58	85	AE	4C	38	1D	A0	00	B1
1C60	A5	D0	01	60	C9	03	D0	48
1C68	A9	DC	8D	0A	90	A5	8F	8D
1C70	8E	90	A0	00	05	82	E6	00
1C78	10	F0	A5	81	69	01	85	81
1C80	A5	80	69	00	85	80	D0	48
1C88	48	A5	81	48	48	A8	84	00
1C90	68	29	0F	09	30	99	82	10
1C98	00	68	4A	4A	4A	4A	09	30
1CA0	99	82	18	90	D0	E9	D0	68
1CA8	8A	E0	E0	0A	B1	A5	C9	60
1CB0	10	03	4C	38	1D	C6	81	D0
1CB8	4E	A5	C1	C5	80	30	17	D0
1CC0	06	A5	C2	C5	81	30	0F	A0
1CC8	03	A9	FE	85	FC	20	8A	13
1CD0	00	D0	F0	4C	56	12	20	50
1CD8	13	A5	80	85	C1	A5	81	85
1CE0	C2	A5	80	08	48	48	A5	81
1CE8	48	48	A8	84	00	68	29	0F
1CF0	09	30	99	18	10	88	68	4A
1CF8	4A	4A	4A	09	30	99	18	10
1D00	98	D0	E9	D0	4C	56	12	A9
1D08	F8	85	FC	20	8A	13	4C	68
1D10	12	44	49	20	45	51	55	28
1D18	24	31	39	40	45	4C	4F	44
1D20	F5	F5	F5	F5	F5	F5	F5	F5
1D28	F5	F5	F5	F5	F5	F5	F5	F5
1D30	A9	FA	85	FF	A2	7F	CA	D0
1D38	FD	E6	FF	D0	F8	EA	A5	00
1D40	F0	84	A4	A7	38	80	A5	FA
1D48	85	FF	A6	98	CA	D0	FD	E6
1D50	FF	D0	F9	A2	00	A4	AC	85
1D58	A3	99	03	12	E8	EC	F0	04
1D60	E0	C8	10	F3	A5	AC	D0	0D
1D68	A5	89	C5	A0	D0	03	4C	68
1D70	12	A5	00	D0	03	4C	A8	18
1D78	A5	A8	C9	16	F0	60	C9	02
1D80	F0	5C	A5	89	C9	40	D0	04
1D88	A9	10	85	89	A4	89	A2	00
1D90	B9	03	12	95	A3	C8	C0	E8
1D98	E0	D0	F5	18	A5	89	69	18
1DA0	85	89	A9	60	8D	D1	18	A5
1DA8	AA	C9	08	D0	0D	A5	A8	C9
1DB0	09	D0	07	A9	00	85	AE	4C
1DB8	00	19	A5	A8	F0	0D	C9	0F
1DC0	30	06	A9	00	85	A8	F0	03
1DC8	4C	A3	20	A5	A9	F0	09	C9
1DD0	0F	30	F5	A9	00	85	A9	A5
1DD8	AE	F0	03	4C	00	1E	A5	A9
1DE0	D0	0C	A9	00	85	FF	AA	E8
1DE8	D0	FD	E6	FF	D0	F9	A5	00
1DF0	8D	13	91	AD	11	91	85	00
1DF8	29	04	D0	21	A5	A5	D0	1A
1E00	A9	1C	85	A6	A9	EF	85	A3
1E08	A9	11	85	A4	A0	00	A9	37
1E10	85	A5	A9	10	85	A6	A9	00
1E18	91	A5	4C	84	1A	A5	00	29
1E20	08	D0	CB	A5	A9	D0	1A	A9

(listing continued on page 97)


Can you rise from the void
to meet the challenge of the
Maziacs
Spectrum
Maziacs
dk'tronics
MAZIACS
dk 018
HAIL THE HERO
The most ingeniously animated little fellow ever seen on a Spectrum screen. Running in all directions fighting, blinking, tapping his feet and sitting down for a well earned rest.
MEET THE MAZIACS
Correction! DON'T meet the Maziacs. Herds of nasty spidery beetly things with long hairy legs and lethal jaws.
MANAGE THE MAZE
And what a maze – Full of Maziacs, Food, Swords, Prisoners, and a endless succession of dead ends and false trails. But don't despair — you have lots of help in your search for a single box of treasure buried deep in the maze of heavily defended passageways.
NOBBLE THE NASTIES
A top Hollywood stunt man was specially flown in to stage the numerous fight sequences needed to defeat the evil guardians of the treasure.
HEAD FOR HOME
Face a return journey with a burden of treasure and unable to carry a sword.
FEATURES
MACHINE CODED COLOURFUL HIGH RES GRAPHICS · PAGE SELECT INSTRUCTIONS, INFORMATION, KEY CHANGE OPTIONS AT ANY STAGE — EVEN DURING A GAME! · KEMPSTON TYPE JOYSTICK OPTION · LEVELS OF DIFFICULTY OPTION · STRATEGY PLANNING VIEWS OF MAZE DURING THE GAME · COMPLETELY NEW RANDOM MAZE FOR EVERY GAME
This game must be seen to be believed. One of the best uses of Spectrum in all aspsects that I have seen.
HOME COMPUTING WEEKLY 27 SEPTEMBER 1983
Available from BOOTS, W.H. SMITH, LASKY'S, SPECTRUM, JOHN MENZIES and good computer software stockists throughout the UK or direct for only £6.95 + 50p post and packing.
DK Tronics Ltd., Unit 6, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ. Telephone: (0799) 26350 (24 hrs) 5 lines
dk'tronics

```
10 REM A SIMPLE BUT VERY USEFULL TOOL
   TO ENTER A MACHINE PROGRAM
20 REM   BY HERMANN HIRSCH
30 REM       WIGBERTSTR.47
40 REM    D 4904 ENGER
50 FORI=834TO900:READR:POKEI,R:NEXT
60 DATA169,0,141,64,3,141,65,3,160,0,
   173,60,3,133,0,173,61,3,133,1
62 DATA177,0,24,42,109,64,3,141,64,3,77,
   65,3,141,65,3,24,238,60,3,208,3,238,61,3
64 DATA173,63,3,205,61,3,240,3,76,74,3,173,
   62,3,205,60,3,208,200,96,0,0
100 PRINT"■■    SIMPLEMONITOR"
110 PRINT:PRINT"  ONLY TWO FUNCTIONS":
   PRINT:PRINT"ALL NUMBERS ARE IN HEX
115 PRINT"ALSO YOUR INPUTS MUST BE SO":PRINT
120 PRINT"■C■HANGE MEMORY  ":PRINT
130 PRINT"■S■UM(BUILDS A CHECKSUM)"
135 GETA$:IFA$=""THEN135
140 IFLEFT$(A$,1)="C"THEN200
150 IFLEFT$(A$,1)<>"S"THEN100
154 PRINT"START ADR.:";:INPUTSA$
156 PRINT:PRINT"END   ADR.:";:INPUTEA$
158 H$=SA$:GOSUB1000:REM HEX -> DEC
160 HB=INT(D/256):LB=D-HB*256
162 POKE828,LB:POKE829,HB
164 H$=EA$:GOSUB1000
166 HB=INT(D/256):LB=D-HB*256
168 POKE830,LB:POKE831,HB
170 SYS834
182 CS=PEEK(832)+PEEK(833)*256:FORI=0TO21:
   PRINT"*";:NEXT
184 PRINT"CHECKSUM = "CS:FORI=0TO21:
   PRINT"*";:NEXT:PRINT:GOTO120
200 REM INPUT
210 PRINT"START ADR.:";:INPUTSA$
220 H$=SA$:GOSUB1000
230 AA=D
240 AD=AA:L=3:GOSUB1100
250 PRINTH$;:AA=AD:AD=PEEK(AD):
   L=1:GOSUB1100:PRINTTAB(7)H$:H$=""
255 FORY=1TO2
260 POKE650,128:GETA$:IFA$=""THEN260
270 IFASC(A$)=136THENAA=AA+1:GOTO240
280 IFASC(A$)=133THENAA=AA-1:GOTO240
290 POKE650,0:IFASC(A$)=13THEN210
295 IFA$<"0"ORA$>"9"ANDA$<"A"ORA$>"F"THEN100
300 H$=H$+A$:PRINT"□"TAB(10)"->   "H$
310 NEXT:GOSUB1000
320 POKEAA,D:AA=AA+1:GOTO240
1000 D=0:IFH$>""THENFORI=1TOLEN(H$):
    A=ASC(MID$(H$,I,1))-48:D=D*16+A+(A>9)*7:NEXT
:RETURN
1100 ZD=AD:H$=""
1110 FORI=LTO0STEP-1
1120 Z1%=ZD/(16↑I)
1130 H$=H$+CHR$(Z1%+48-(Z1%>9)*7):
    ZD=ZD-Z1%*(16↑I):NEXT:RETURN
2000 REM HERE ARE THE CHECKSUMS FOR 'VICMAN'
2010 REM FROM 1200-1300->48235
2020 REM FROM 1200-1400->45674
2030 REM FROM 1200-1500->33748
2040 REM FROM 1200-1600->47188
2050 REM FROM 1200-1700->16690
2060 REM FROM 1200-1800->41196
2070 REM FROM 1200-1900->27972
2080 REM FROM 1200-1A00->49377
2090 REM FROM 1200-1B00->18503
2100 REM FROM 1200-1C00->18947
2110 REM FROM 1200-1D00-> 9620
2120 REM FROM 1200-1E00->11713
2130 REM FROM 1200-1F00->46006
2140 REM FROM 1200-2000->11739
2150 REM FROM 1200-2100->41792
2160 REM FROM 1200-2200->45422
2170 REM FROM 1200-2300->55408
2180 REM IF YOU ARE A LUCKY MAN THE LAST
    CHECKSUM IS CORRECT AT THE FIRST ATTEMPT
```

(listing continued from page 95)

```
1E20  37 85 A3 A9 10 85 A4 A9
1E28  A2 85 A0 AD 00 A9 EF 85
1E30  A5 A5 11 85 A6 A9 00 91
1E40  A5 4C 82 1B 38 A0 00 12
1E48  E5 AB 10 06 38 A9 AB ED
1E50  00 12 05 24 38 A0 0A 12
1E58  E5 AA 10 26 38 A5 AA ED
1E60  0A 12 85 85 C5 84 10 34
1E68  A5 AF C9 00 F0 11 C9 10
1E70  F0 0D A0 00 12 C5 A8 38
1E78  03 4C E1 20 4C 06 20 A5
1E80  AA CD 0A 12 F0 EC 38 A5
1E88  84 E5 85 C9 03 10 E3 A5
1E90  AA CD 0A 12 30 03 4C C8
1E98  20 4C C0 20 A5 AF C9 04
1EA0  F0 04 C9 08 D0 E5 A5 AB
1EA8  CD 0B 12 F0 E2 38 A5 85
1EB0  E5 84 C9 03 30 D9 10 BA
1EB8  A8 00 C9 04 D0 03 4C 60
1EC0  1F C9 08 D0 03 4C 35 1F
1EC8  C9 00 F0 30 C9 10 F0 83
1ED0  4C 87 1F 38 A5 A3 E9 01
1ED8  85 A5 A5 A4 E9 00 85 00
1EE0  A9 04 D1 A5 30 07 A9 00
1EE8  85 AE 4C C8 20 C5 AF D0
1EF0  03 4C 06 20 A5 AF C9 08
1EF8  D0 03 4C E1 20 A9 00 85
1F00  AE 4C 20 1D 18 A5 A3 69
1F08  01 85 A5 A5 A4 69 00 85
1F10  A6 A0 04 D1 A5 30 07 A9
1F18  00 85 AE 4C C8 20 A5 AF
1F20  C9 04 D0 03 4C D6 20 C9
1F28  08 D0 03 4C E1 20 A9 00
1F30  85 AE 4C 30 1D 18 A5 A3
1F38  69 16 85 A5 A5 A4 69 00
1F40  85 A6 A0 04 D1 A5 30 07
1F48  A9 00 85 AE 4C E1 20 A5
1F50  AF C9 08 D0 03 4C C8 20
1F58  C9 10 D0 03 4C C8 20 A9
1F60  00 85 AE 4C 38 1D 38 A5
1F68  A3 E9 16 85 A5 A5 A4 E9
1F70  00 85 A6 A9 04 D1 A5 30
1F78  07 A9 00 85 AE 4C D6 20
1F80  A5 AF C9 08 D0 03 4C C8
1F88  20 C9 10 D0 03 4C C8 20
1F90  A9 00 85 AE 4C 38 1D A5
1F98  AF C9 04 D0 03 4C 65 20
1FA0  C9 08 D0 03 4C 27 20 C9
1FA8  00 F0 3E A9 10 85 AE A5
1FB0  AB CD 0B 12 38 1D 38 A5
1FB8  A3 E9 16 85 A5 A5 A4 E9
1FC0  00 85 A6 B1 A5 C9 04 10
1FC8  03 4C D6 20 A9 00 85 AE
1FD0  4C C0 20 18 A5 A3 69 16
1FD8  85 A5 A5 A4 69 00 85 A6
1FE0  B1 A5 C9 04 10 D6 4C E1
1FE8  20 A9 00 85 AE A5 AB CD
1FF0  0B 12 38 1D 38 A5 A3 E9
1FF8  16 85 A5 A5 A4 E9 00 85
2000  A6 B1 A5 C9 04 10 03 4C
2008  D6 20 A9 00 85 AE 4C C0
2010  20 18 A5 A3 69 16 85 A5
2018  A5 A4 69 00 85 A6 B1 A5
2020  C9 04 10 D0 4C E1 20 A9
2028  00 85 AE A5 AA CD 0A 12
2030  38 1D 38 A5 A3 E9 01 85
2038  A5 A5 A4 E9 00 85 A6 B1
2040  A5 C9 04 10 03 4C C8 20
2048  A9 00 85 AE 4C D6 20 18
2050  A5 A3 69 01 85 A5 A5 A4
2058  69 00 85 A6 B1 A5 C9 04
2060  10 DA 4C C8 20 A9 04 85
2068  AE A5 AA CD 0A 12 38 1D
2070  38 A5 A3 E9 01 85 A5 A5
2078  A4 E9 00 85 A6 B1 A5 C9
2080  04 10 03 4C C8 20 A9 00
2088  85 AE 4C E1 20 18 A5 A3
2090  69 01 85 A5 A5 A4 69 00
2098  85 A6 B1 A5 C9 04 10 D0
20A0  4C C8 20 A0 52 85 FE A9
20A8  FF 85 FF 20 EC 20 A5 AF
20B0  C9 00 F0 0C C9 10 F0 13
20B8  C9 04 F0 1A C9 08 F0 21
20C0  A9 00 85 AF A9 00 85 A7
20C8  4C 00 19 A9 1A 85 AF A9
20D0  00 85 A7 4C FC 19 A9 04
20D8  85 AF A9 20 85 A7 4C 04
20E0  1A A9 08 85 AF A9 70 85
20E8  A7 4C 02 18 85 FF A6 FE
20F0  CA D0 FD C6 FF D0 F7 60
20F8  F7 FD FD FD FD FD FD FD
2100  20 20 20 20 20 20 20 20
2108  20 20 20 20 20 49 4A 20
2110  20 20 20 20 20 20 20 44
2118  45 46 47 48 40 41 42 43
2120  20 20 20 48 4C 20 20 20
2128  20 20 20 20 1D 1C 1C 1C
2130  1C 1C 1C 1C 27 1C 21 00
2138  1F 27 1C 1C 1C 1C 1C 1C
2140  1C 1E 1B 03 03 03 03 03
2148  03 03 1B 03 03 03 03 1B
2150  03 03 03 03 03 03 03 1B
2158  1B 00 1C 00 1B 00 1C 00
2160  1B 00 1C 1C 00 1B 00 1C
2168  00 1D 00 1C 00 1D 1D 03
2170  03 03 1B 03 03 03 03 03
2178  03 03 03 03 03 03 03 1B
2180  03 03 03 1B 24 1C 00 1C
2188  21 00 1C 1C 1E 00 1C 1C
2190  00 1D 1C 1C 00 1F 1C 00
2198  1C 25 1B 03 03 03 03 03
21A0  03 03 1B 03 03 03 03 1B
21A8  03 03 03 03 03 03 03 1B
21B0  1D 00 1C 00 1D 00 1C 00
21B8  1B 00 1D 1C 00 1B 00 1C
21C0  00 1B 00 1C 00 1B 1B 03
21C8  03 03 1B 03 03 03 03 03
21D0  1B 00 00 03 03 03 03 1B
21D8  03 03 03 1B 24 1C 00 1C
21E0  21 00 1C 1C 1E 00 1F 1C
21E8  00 1D 1C 1C 00 1F 1C 00
21F0  1C 25 1B 03 03 03 03 03
21F8  03 03 1B 03 03 03 03 1B
2200  03 03 03 03 03 03 03 1B
2208  1B 00 1C 00 1B 00 1C 00
2210  1B 00 1C 1C 00 1B 00 1C
2218  00 1B 00 1C 00 1B 1B 03
2220  03 03 1B 03 03 03 03 03
2228  03 03 03 03 03 03 03 1B
2230  03 03 03 1B 24 1C 00 1C
2238  21 00 1C 1C 1E 00 1C 1C
2240  00 1D 1C 1C 00 1F 1C 00
2248  1C 25 1B 03 03 03 03 03
2250  03 03 1B 00 50 00 00 1B
2258  03 03 03 03 03 03 03 1B
2260  1B 00 1C 00 1B 00 1C 00
2268  1B 00 1C 1C 00 1B 00 1C
2270  00 1B 00 1C 00 1B 1B 03
2278  03 03 1B 03 03 03 03 03
2280  03 03 03 03 03 03 00 1B
2288  03 03 03 1B 24 1C 00 1C
2290  21 00 1C 1C 1E 00 1C 1C
2298  00 1D 1C 1C 00 1F 1C 00
22A0  1C 25 1B 03 03 03 03 03
22A8  03 03 1B 03 03 03 03 1B
22B0  03 03 03 03 03 03 03 1B
22B8  1B 00 1C 00 1D 00 1C 00
22C0  1B 00 1C 1C 00 1B 00 1C
22C8  00 1B 00 1C 00 1B 1B 03
22D0  03 03 1B 03 03 03 03 03
22D8  03 03 03 03 03 03 03 1B
22E0  03 03 03 1B 1F 1C 1C 1C
22E8  20 1C 1C 1C 1C 1C 1E 00
22F0  1D 1C 1C 1C 1C 20 1C 1C
22F8  1C 21 33 A9 38 00 13 06
2300 000
```

PLANE ANNOYING

Kriss Buddle taxes your thinking and perceiving facilities with a tantalisingly mind blowing puzzle for the ZX-81. A worthy rival for Rubik's cube.

SOME TIME AGO, before taking my first plunge into the world of machine code, I played a pub Pac-Man machine and was startled to find myself suddenly faced with one side of a scrambled Rubik's cube and being told to sort it out! You probably know the one I mean. This gave me the idea for a slightly more complex game, based on the Cube.

Having sweated over a Basic program I found it to be slow and requiring vast amounts of memory. I therefore decided that machine code was the only answer. During the time it took me to translate the original program the inevitable happened — someone released an almost identical game for the Spectrum.

However, it is still a good game and, as I have never seen a ZX-81 implementation, here it is in all its glory.

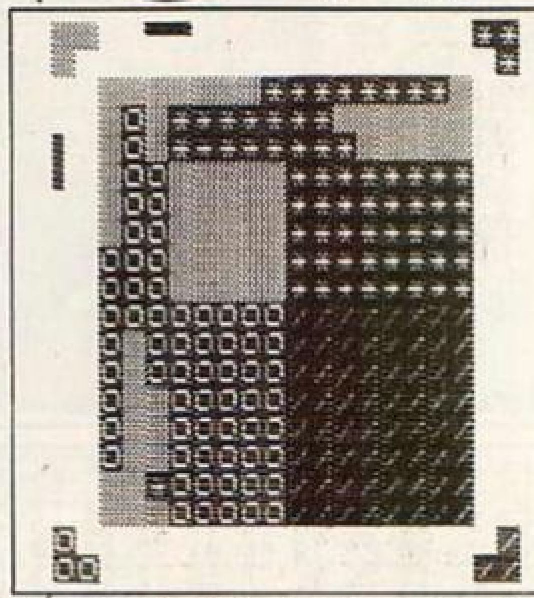
Basically you are presented with a 16 by 16 plane each 8 by 8 corner of which is composed of a different character. You may choose how many smaller squares the plane is to be split into and also have the choice of an easy or a difficult mode to play in.

The machine then scrambles the plane by randomly scrolling rows and columns, thus mixing the characters up. Your not inconsiderable task is to restore the plane to its original pattern. If you manage to do this you are given the number of moves it took. The whole object is to take as few moves as possible.

The machine code section occupies 652 bytes, so you will have to create a Rem statement followed by at least 652 X's or any other character. To check that you have the correct number of bytes in the Rem type

PRINT PEEK 16511 +
256*PEEK 16512-2 (+ NEWLINE)

This should give a value of 652 or more. If you obtain less, then keep on typing. Fast mode is less tiresome.



Having reserved the space, use one of the many hex loaders, previously published in this and other magazines and books, to enter the code in the hex dump. Remember there are no spaces between the pairs of hex digits when entering the code.

The machine code has been written in the form of a series of subroutines, each performing a specific task. Not only does this make debugging easier — especially without the help of an assembler, compiler or monitor — but also simplifies the disassembly and understanding of the code.

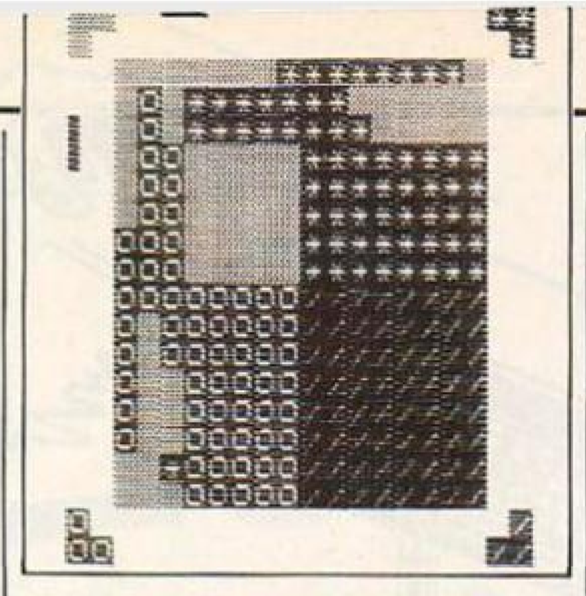
The main module is a keyboard scanner which calls the ROM routine at 02BB (hex), decides which key is being pressed and then calls the relevant subroutine.

The Decimal addresses in listing 1 mark the beginning of each subroutine in the program and by Peeking these addresses the following values should be obtained, thereby proving that the code is probably correct:

16514 = 118
16618 = 205
16677 = 42
16718 = 42
16771 = 42
16807 = 42
16850 = 237
16887 = 237
16951 = 237
16997 = 237
17042 = 42
17121 = 6
17134 = 33
17160 = 62

If all these values are correct then delete the

(continued on next page)



(continued from previous page)

Hex loader line by line and type, as a direct command

POKE 16510, 0

This will give you a non-erasable Rem line. Then Save the Rem statement to tape as a precaution.

The Basic part of the program is a lot friendlier than the machine code. Keeping your Rem statement in memory, type in listing 2 as written and again Save the entire thing to tape by typing

RUN 5000 (+ NEWLINE)

The program should now auto-run and the invitation to see the instructions or play the game should be on the screen. Until you have actually seen the plane the instructions could be a little confusing, unless you have a vivid imagination, hence the short demonstration at the end of the instruction pages.

The puzzle is simple to play but difficult to describe and to finish. The demonstration is in easy mode where the cursors control individual rows and columns on the plane.

In difficult mode the cursors are twice as wide and can only move adjacent pairs of rows and columns, but still maintain the smaller units into which the plane has been split. I said it was easier to play than to explain.

Lines 290 and 2000 are identical and very important. Not only do they provide a visual clue as to which corner the characters belong in, but the machine code uses them to prevent the cursors running off the screen and causing an irrevocable crash.

Variables.

- A$ — Holds various messages and is used to store values in string form for use in several parts of the program.
- I$ — Used as input from player and temporarily holds option choices.
- X — Holds the size of division selected by the player.
- L — Used to call USR routines (LET L = USR) instead of RAND USR, as that way a randomness is preserved, otherwise the random numbers always start from the same seed.
- N + F — Loop control variables.

Basic listing.

```
   5 CLS
  10 PRINT TAB 8;"PLANE ANNOYING"
  20 PRINT ,,,,"PRESS;-",,,,"1) FOR INSTRUCTIONS.",,,"2) TO START GAME."
  30 GOSUB 1000
  40 IF I$="2" THEN GOTO 500
  50 CLS
  55 LET A$="*****PRESS N/L TO CONTINUE****"
  60 PRINT "THE OBJECT OF THE GAME IS TO",,,"UN-SCRAMBLE A 16 X 16 GRID OF",,,"CHARACTERS INTO ITS ORIGINAL",,,"PATTERN (EACH 8 X 8 CORNER BEING",,"COMPOSED OF A DIFFERENT",,,"""CHARACTER"")"
  70 PRINT ,,"THE COMPUTER WILL SCRAMBLE THE",,,"PLANE IN FULL VIEW, ACCORDING",,,"TO THE LEVEL OF DIFFICULTY",,,"CHOSEN."
  80 PRINT ,,A$
  85 IF INKEY$="" THEN GOTO 85
  90 CLS
 100 PRINT "AT THE MOST DIFFICULT LEVEL THE",,,"PLANE IS DIVIDED INTO ITS 256",,,"SEPARATE SQUARES, (IE. 16 X 16)",,,"AND, AT ITS SIMPLEST, INTO 16",,,"SQUARES, (IE. 4 X 4)."
 110 PRINT ,,"THERE ARE ALSO TWO ""MODES"" TO",,,"CHOOSE FROM. MODE 1 PUTS EACH",,,"ROW OR COLUMN UNDER INDIVIDUAL",,,"CONTROL AND COMPLETING THE PLANE",,"IS QUITE PAINLESS."
 115 PRINT ,,A$
 120 IF INKEY$="" THEN GOTO 120
 125 CLS
 130 PRINT "MODE 2 ALLOWS YOU ONLY TO MOVE",,,"ROWS AND COLUMNS IN ADJACENT",,,"PAIRS, MAKING THE PLANE MUCH",,,"MORE DIFFICULT TO COMPLETE."
 140 PRINT ,,"THE CURSORS ARE MOVED WITH",,,"""SHIFTED"" CURSOR CONTROL KEYS",,,"(IE. SHIFTED ""8"" = RIGHT)."
 150 PRINT ,,"UNSHIFTED KEYS 5-8 WILL SCROLL",,,"THE ROW OF COLUMN POINTED TO",,,"BY THE CURSOR IN THE RELEVANT",,,"DIRECTION."
 160 PRINT A$
 165 IF INKEY$="" THEN GOTO 165
 170 CLS
 180 PRINT "THE PLANE HAS ""WRAP-AROUND""",,,"SO THAT ANYTHING SCROLLING OFF",,,"TO THE LEFT OR RIGHT RE-APPEARS",,,"AT THE OTHER SIDE.",,,,,"TO RESIGN FROM THE GAME PRESS",,,"""SHIFTED"" 1. THIS WILL TELL YOU",,,"HOW MANY MOVES IT TOOK TO BE",,,"DEFEATED. IF YOU COMPLETE THE",,,"PLANE YOU WILL GET A MOVE COUNT",,,"AND AN OPTION TO PLAY AGAIN."
 190 PRINT ,,A$
 195 IF INKEY$="" THEN GOTO 195
 200 CLS
 210 PRINT "PRESS;-",,,,"""D"" FOR A DEMONSTRATION.",,,"ANY OTHER KEY TO PLAY."
 220 IF INKEY$="" THEN GOTO 220
 230 IF INKEY$<>"D" THEN GOTO 500
 240 LET X=4
 250 POKE 17158,X
 260 POKE 17159,X
 270 CLS
 280 PRINT AT 0,0;"EASY MODE WITH 4 X 4 DEFINITION."
 290 PRINT AT 1,6;"▒▒";TAB 24;"■■";TAB 6;"▒";TAB 25;"■";AT 19,6;"■";TAB 25;"■";TAB 6;"■■";TAB 24;"■■"
 300 LET L=USR 16516
 310 LET A$="57575757"
 320 FOR N=1 TO X
 330 FOR F=1 TO RND*8+1
 340 POKE 17161,CODE A$(INT (RND*8+1))
 345 LET L=L**N
 350 LET L=USR 17160
 360 NEXT F
 370 POKE 17161,115
 380 LET L=USR 17160
 390 POKE 17161,113
 400 LET L=USR 17160
 410 NEXT N
 420 PRINT AT 21,0;"*****PRESS N/L TO START GAME****"
 430 IF INKEY$="" THEN GOTO 430
 500 FOR N=16514 TO 17165 STEP 8
 505 LET A$="124"
 510 LPRINT N;" ";
 520 FOR B=0 TO 7
 530 LET C=PEEK (B+N)
 540 LPRINT CHR$ (28+INT (C/16));CHR$ (28+C-16*INT (C/16));" ";
 550 LET X=VAL A$(VAL I$)
 560 IF (B+N)=17165 THEN STOP
 570 NEXT B
 580 LPRINT
 590 NEXT N
 595 STOP
 600 POKE 17158,X+X*(I$="2")
 610 POKE 17159,X
 620 CLS
 630 GOSUB 2000
 635 PRINT AT 20,11;"
 640 IF L THEN GOTO 700
 650 PRINT AT 0,0;"COMPLETED IN;- ";PEEK 16448+256*PEEK 16449;" MOVES."
 660 PRINT AT 21,0;"***PRESS N/L FOR ANOTHER GAME***"
 670 IF INKEY$<>"" THEN GOTO 670
 680 GOTO 0+680*(INKEY$="")
 700 PRINT AT 0,0;PEEK 16448+256*PEEK 16449;" MOVES.(UNFINISHED)"
 710 GOTO 660
1000 LET I$=INKEY$
1010 IF I$<"1" OR I$>"3" THEN GOTO 1000
1020 RETURN
2000 PRINT AT 1,6;"▒▒";TAB 24;"■■";TAB 6;"▒";TAB 25;"■";AT 19,6;"■";TAB 25;"■";TAB 6;"■■";TAB 24;"■■"
2005 LET A$="57575757"
2010 LET L=USR 16516
2020 FOR N=1 TO 16/X-2*(I$="2")-(I$="1")
2030 GOSUB 3000
2040 POKE 17161,113
2045 LET L=USR 17160
2050 GOSUB 3000
2060 POKE 17161,115
2070 LET L=USR 17160
2080 GOSUB 3000
2090 NEXT N
2095 PRINT AT 20,11;"SCRAMBLED"
2100 LET L=USR 17134
2110 RETURN
3000 FOR F=1 TO RND*8+1
3010 POKE 17161,CODE A$(INT (RND*8)+1)
3020 LET L=USR 17160
3030 NEXT F
3040 RETURN
5000 SAVE "PLANE ANNOYING"
5010 RUN
A001 [illegible]
```

Hex dump.

```
16514 76 76 2A 0C 40 01 6C 00
16522 09 3E 08 32 21 40 3E 97
16530 32 7B 40 11 11 00 06 02
16538 C5 0E 08 3A 21 40 06 08
16546 77 23 10 FC 3A 7B 40 06
16554 08 77 23 10 FC 19 0D 20
16562 EA 3E B4 32 21 40 3E 98
16570 32 7B 40 C1 10 DA 2A 0C
16578 40 11 2A 00 19 22 3C 40
16586 11 40 00 19 22 3E 40 3E
16594 05 ED 4B 06 43 41 11 21
16602 00 77 19 10 FC 2A 3C 40
16610 3E 03 41 77 23 10 FC C9
16618 CD BB 02 2C 20 FA CD B5
16626 02 E5 C1 2C 28 F3 CD BD
16634 07 7E FE 70 CC 25 41 FE
16642 71 CC 4E 41 FE 72 CC 83
16650 41 FE 73 CC A7 41 FE 23
16658 CC D2 41 FE 22 CC 02 42
16666 FE 21 CC 37 42 FE 24 CC
16674 65 42 C9 2A 3E 40 ED 4B
16682 05 43 11 21 00 C5 AF ED
16690 52 7E FE 08 28 14 10 F6
16698 22 3E 40 3E 05 C1 77 19
16706 0D 20 FB FE 01 D8 AF 48
16714 18 F4 C1 C9 2A 3E 40 ED
16722 4B 06 43 11 21 00 C5 0D
16730 28 04 19 0D 20 FC C1 C5
16738 19 7E FE B4 28 19 10 F8
16746 AF 3E 05 C1 77 ED 52 0D
16754 20 FA 19 FE 01 D8 22 3E
16762 40 AF ED 52 48 18 ED C1
16770 C9 2A 3C 40 ED 4B 06 43
16778 C5 28 7E FE 08 28 14 10
16786 F8 22 3C 40 C1 3E 03 77
16794 23 0D 20 FB FE 01 D8 AF
16802 48 18 F4 C1 C9 2A 3C 40
16810 ED 4B 06 43 2B C5 23 0D
16818 20 FC 23 7E FE 97 28 16
16826 10 F8 C1 3E 03 77 2B 0D
16834 20 FB FE 01 D8 23 22 3C
16842 40 AF 2B 48 18 EF C1 C9
16850 ED 4B 06 43 C5 2A 3C 40
16858 11 21 00 19 19 E5 E5 7E
16866 32 21 40 06 0F 19 7E E3
16874 77 19 19 10 F9 AF ED 52
16882 3A 21 40 77 E1 E1 23 0D
16890 20 E3 C1 10 D7 C3 92 42
16898 ED 4B 06 43 C5 2A 3C 40
16906 11 31 02 19 11 21 00 E5
16914 E5 7E 32 21 40 06 0F AF
16922 ED 52 7E E3 77 AF ED 52
16930 ED 52 10 F6 19 3A 21 40
16938 77 E1 E1 23 0D 20 E0 C1
16946 10 D2 C3 92 42 ED 4B 06
16954 43 11 21 00 C5 2A 3E 40
16962 23 23 E5 E5 7E 32 21 40
16970 06 0F 23 7E E3 77 23 23
16978 10 F9 2B 3A 21 40 77 E1
16986 E1 19 0D 20 E5 C1 10 DC
16994 C3 92 42 ED 4B 06 43 C5
17002 2A 3E 40 11 11 00 19 11
17010 21 00 E5 E5 7E 32 21 40
17018 06 0F 2B 7E E3 77 2B 2B
17026 10 F9 23 3A 21 40 77 E1
17034 E1 19 0D 20 E5 C1 10 D7
17042 2A 0C 40 01 6C 00 09 1E
17050 08 0E 08 CD E1 42 FE FF
17058 28 35 0E 97 CD E1 42 FE
17066 FF 28 2C 01 11 00 09 1D
17074 20 E7 1E 08 0E B4 CD E1
17082 42 FE FF 28 1A 0E 98 CD
17090 E1 42 FE FF 28 11 01 11
17098 00 09 1D 20 E7 2A 40 40
17106 23 22 40 40 3E FE C9 2A
17114 40 40 23 22 40 40 C9 06
17122 08 7E B9 28 03 3E FF C9
17130 23 10 F6 C9 21 00 00 22
17138 40 40 CD EA 40 FE 75 28
17146 08 FE FE 20 F5 01 00 00
17154 C9 0E 0E C9 02 01 3E 73
17162 CD FC 40 C9
```

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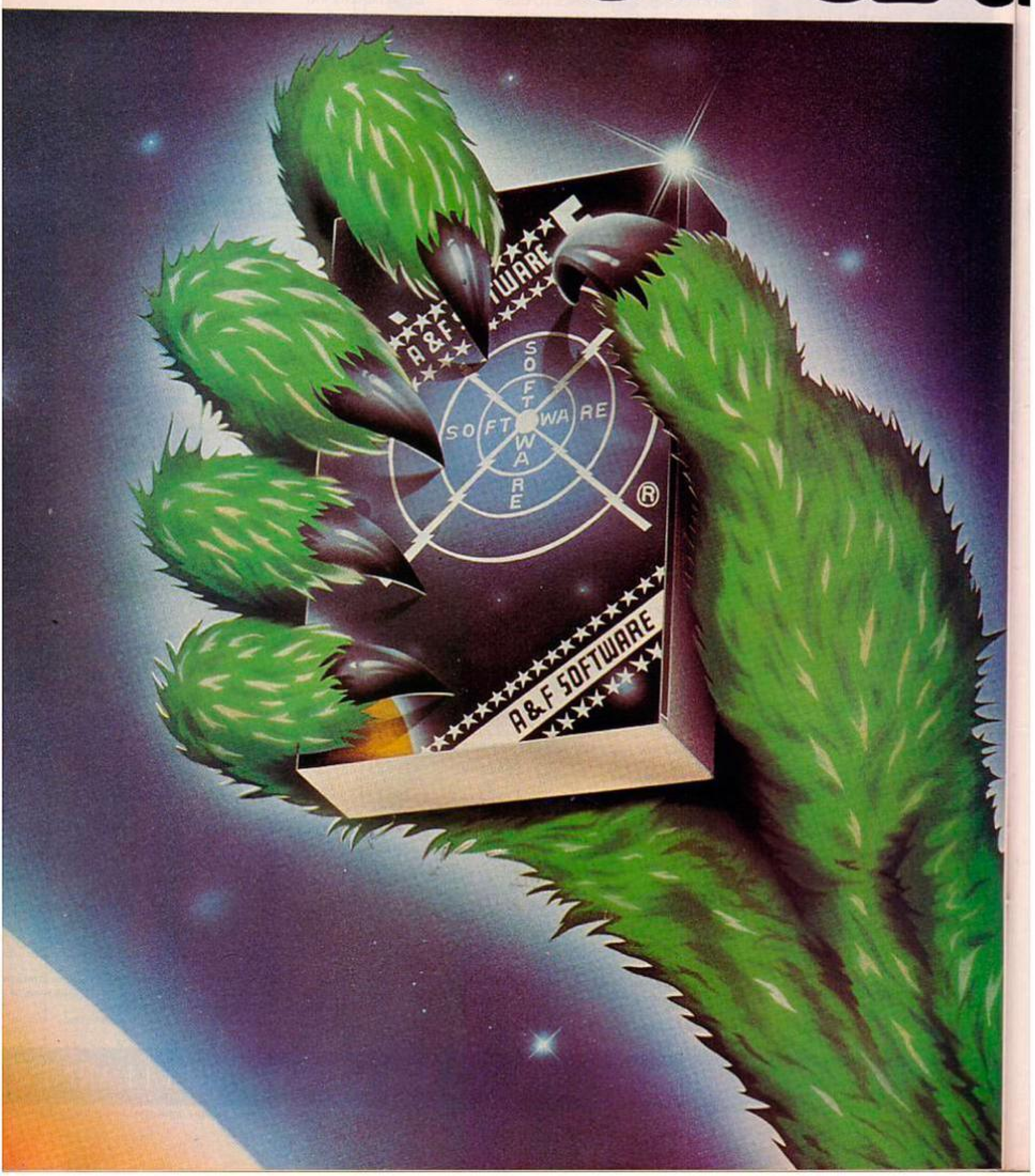
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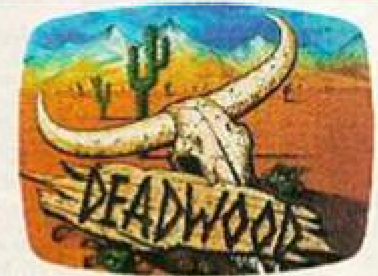


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MUSIC



Play bars with Gavin Rummery's Oric music program.

THIS PROGRAM ALLOWS you to enter notes from sheets of music. When it loads, four staves are drawn onto the screen. You are then asked the maximum number of notes you need, the length of the crotchets — about 30 is normal — the octave and volume of the notes.

The prompt 'What note do you want next?' will then appear. There are various replies to this question. They are as follows:

1. 'c'-'g' give notes from bottom C to G.
2. 'A'-'G' gives notes from A to top G.
3. Typing 'C#' etc give C# etc.
4. '}' gives a period of silence lasting as long as a crotchet.
5. '.' — full stop — then Return and then entering the note gives a minim.
6. Typing '/' then Return will cause the prompt "How many notes do you want to join?". A number from 2 to 11 should then be entered.

You will then be allowed to enter that number of notes, which will be joined together. Two notes joined together will be played as quavers, four notes will give semi-quavers etc.

7. '?' will tell you how many notes you have used.
8. 'r' will draw up a repeat sign — 11:.
9. 'u' will show the end of the section to be repeated — :11 — Note. You cannot repeat a section inside another section that is being repeated.
10. 's' will erase the last note entered.
11. Finally 'p' will play your master-piece!

After entering each letter or symbol you must press Return.

When you fill the four staves, the screen will be cleared and four more drawn up.

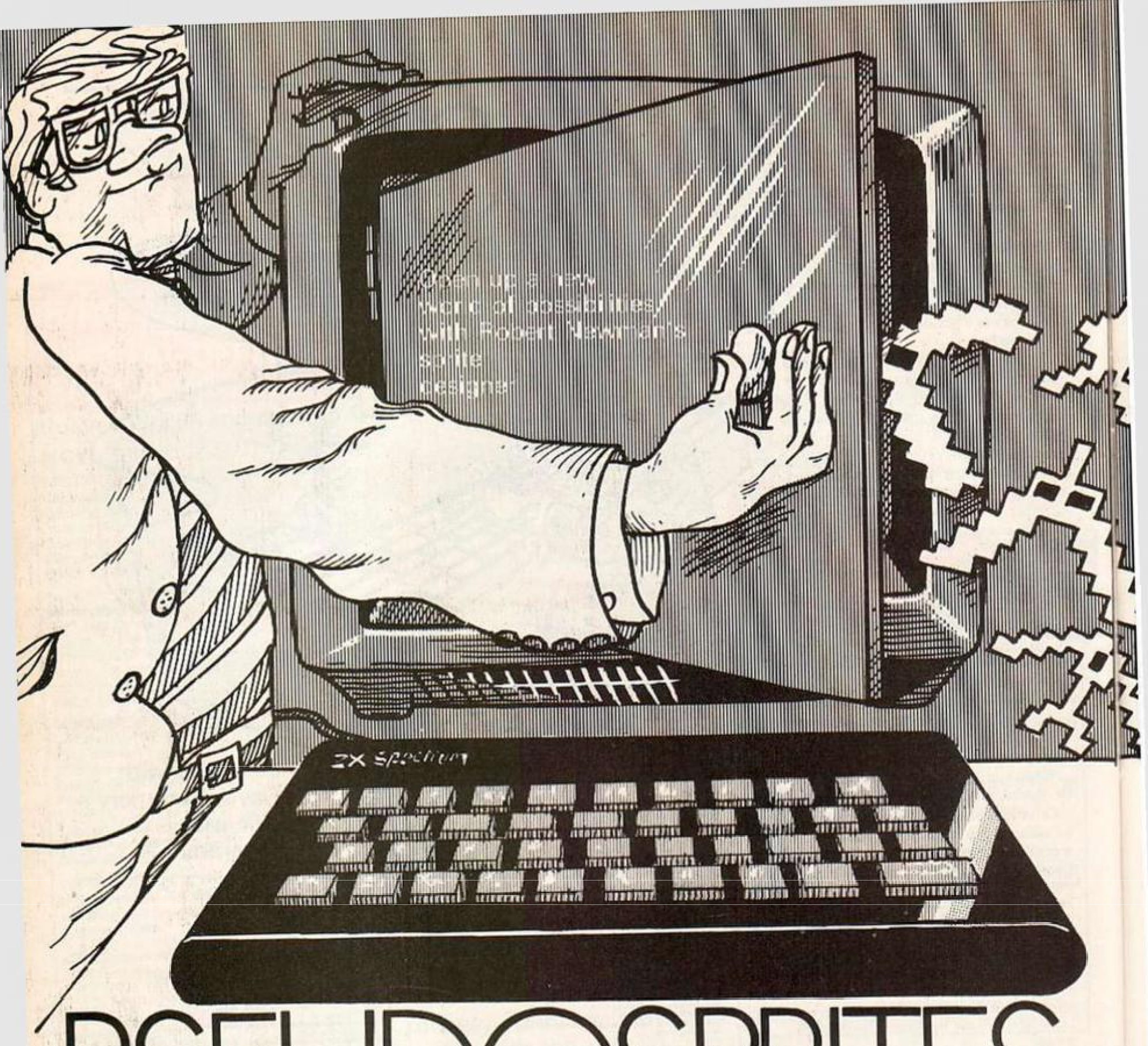
Once the tune has played through you will be asked if you want to add notes and if you want the tune replayed.

Lines 2-190 ask the initial question and draw up the staves.
Lines 200-997 are the main loop.
Lines 1000-1080 define the treble-clefs.
Lines 110-1150 draw the repeat sign.
Lines 1300-1359 repeat the notes between the start and end repeat signes and also draw the end repeat sign.
Lines 2000-3020 play the tune
Lines 500-5020 ask how many notes to be joined.
Lines 5100-5150 join the notes.
Lines 6000-6030 involve the silent '}'.
Lines 8000-8080 rub out the last note entered.



```
2 CLS
4 O=1:R=-1
10 TEXT:GOSUB1000
20 INK0:PAPER6:HIRES:INK0:PAPER6
30 PRINTCHR$(17)
35 IFTM=0THENPRINTCHR$(20);CHR$(6)
40 Z=1
45 FORF=0TO150STEP50
50 FORX=10TO38STEP7
60 CURSET20,X+F,3
70 DRAW200,0,1
80 NEXT
90 NEXT
95 IH=7
100 FORF=0TO150STEP50
120 FORX=8TO32STEP8
130 CURSET22,X+F,3
140 CHARX/8+90,0,1
150 NEXT:NEXT
160 X=30:Y=10
161 XX=X:YY=Y
165 IFTN=1THENTN=0:TM=0:RETURN
170 IFTM=1THENGOTO190
171 INPUT"Number of notes(1TO2000)";NN:IFNN>2000THEN17
1
180 DIMNO(NN):DIML(NN):DIMKO(NN)
181 INPUT"Time gap";LE
182 INPUT"Octave (0TO5)";OK
184 IFOK>5THENGOTO182
185 INPUT"Volume (0TO15)";VO
186 IFVO>15THENGOTO185
190 TM=0
200 PRINT: PRINT:INPUT"What note do you want next";X$
205 IFX$="?"THENPRINTO:GETX$:GOTO200
209 IFX$="s"THENGOTO8000
210 IFX$="r"THENGOTO1100
211 IFX$="}"THENGOTO6000
216 IFX$="p"THENGOTO2000
220 IFX$="u"THENGOTO1300
230 IFRIGHT$(X$,1)="£"THENSH=1
240 IFX$="."THENDO=1:GOTO200
245 IFX$="/"ANDII=0THENJO=1:GOTO5000
```

```
250 IFASC(X$)<65ORASC(X$)>71ANDASC(X$)<99ORASC(X$)>103
THENGOTO200
255 OCTA=OK
260 IFX$="c"THENN=1
261 IFSH=1ANDRIGHT$(X$,1)<>"£"THENX$=X$+"£"
265 IFX$="c£"THENN=2
270 IFX$="d"THENN=3
280 IFX$="d£"THENN=4
290 IFX$="e"THENN=5
300 IFX$="f"THENN=6
310 IFX$="f£"THENN=7
320 IFX$="g"THENN=8
330 IFX$="g£"THENN=9
340 IFX$="A"THENN=10
345 IFX$="A£"THENN=11
350 IFX$="B"THENN=12
360 IFASC(X$)>64ANDASC(X$)<72THENOCTA=OCTA+1:X$=CHR$(A
SC(X$)+32):GO
TO240
370 X=X+6:IFX>220THENX=30:Y=Y+50:IFY>170THENTM=1:TN=1:
GOSUB20
371 IFOCTA<>OKTHENX$=CHR$(ASC(X$)-32)
373 XX=X:YY=Y
375 D=ASC(X$)-99:IFD<0THEND=ASC(X$)-60
376 D=Y+36-D*3.5
380 CURSETX+3,D,1
390 IFDO=1THENCIRCLE2,1:CIRCLE1,0
400 IFDO<>1THENCIRCLE2,1:CIRCLE1,1
405 IFJO=1THENCX(PO)=D:IFD<HITHENHI=D
410 CURSETX+4,D,1:DRAW0,-7,1
411 IFSH=1THENCURSETX,D+3,3:CHAR35,0,1
412 NO(O)=N:KO(O)=OCTA
413 LP=LE:IFDO=1THENLP=LE*2
414 IFJO>0THENLP=LE/OH
416 L(O)=LP
417 MUSIC1,OCTA,NO(O),VO:WAITLP:MUSIC1,0,1,0:O=O+1
419 X1=X+3:D1=D
420 PO=PO+1:IFPO=OHTHENGOSUB5100
430 IFJO=1THENGOTO460
440 X=X+6:IFX>220THENX=30:Y=Y+50:IFY>170THENTM=1:GOTO4
5445 IFDE=1THENGOTO456
450 BAR=BAR+1
455 IFBAR=4THENCURSETX,Y,1:DRAW0,28,1:BAR=0
456 IFDO=1THENDO=2:GOTO440
457 JO=0
460 SH=0:DO=0
470 OCTA=OK
480 IFTM=1THENGOTO20
490 IFO=NN+1THENGOTO2000
500 DE=0
997 GOTO200
998 PRINTCHR$(20);CHR$(6)
999 END
1000 FORI=46600TO46639
1010 READA
1020 POKEI,A
1030 NEXT
1040 RETURN
1050 DATA12,18,18,17,9,9,9
1060 DATA10,6,4,12,20,38,45,45
1070 DATA45,45,37,37,21,14,4,4
1080 DATA4,2,2,2,2,26,26,14,12
1100 IFR<>-1THENGOTO200
1101 R=O
1110 FORC=0TO1
1120 CURSETX+C*2,Y,1:DRAW0,28,1
1130 CURSETX+4,Y+10+C*6,1
1140 NEXT
1150 GOTO200
1300 IFR=-1THENGOTO200
1301 FORW=RTOO
1305 NO(O+W-R)=NO(W)
1306 KO(O+W-R)=KO(W)
1307 L(O+W-R)=L(W)
1308 NEXT
1309 O=O+W-R-1
1310 R=-1
1320 FORC=0TO1
1330 CURSETX+C*2,Y,1:DRAW0,28,1
1340 CURSETX-2,Y+10+C*6,1
1345 NEXT
1346 XX=X:YY=Y
1350 GOTO200
2000 PRINT:PRINT:PRINT"HERE GOES..."
2010 FORW=1TOO-1
2015 IFKO(W)=10THENWAITL(W):GOTO2035
2016 PLAY1,0,0,0
2020 MUSIC1,KO(W),NO(W),VO
2030 WAITL(W)
2035 PLAY0,0,0,0
2040 NEXT
2045 MUSIC1,0,1,0
3000 PRINT:PRINT:INPUT"Repeat";X$
3010 IFX$="y"THENGOTO2000
3011 IFO=NN+1THENGOTO998
3015 PRINT:PRINT:INPUT"Want to add notes";X$
3016 IFX$="y"THENPLAY1,0,0,0:GOTO200
3017 TEXT
3020 GOTO998
5000 PRINT:PRINT:INPUT"How many notes do you want to j
oin";OH
5005 IFOH>11OROH<2THENGOTO5000
5015 II=1
5016 PO=0
5017 IFX+(OH)*6>220THENX=30:Y=Y+50:IFY>170THENTM=1:GOT
O20
5018 HI=Y+40
5020 GOTO200
5100 IFIH<Y-5THENGOTO5109
5105 CURSETX-(OH-1)*6+4,IH-7,0:DRAW(OH-1)*6,0,0
5109 FORHO=0TOOH-1
5110 CURSETX-(OH-1)*6+HO*6+4,CX(HO),1
5120 DRAW0,(HI-7)-CX(HO),1
5130 NEXT
5140 CURSETX-(OH-1)*6+4,HI-7,1:DRAW(OH-1)*6,0,1
5145 II=0
5146 IH=HI
5150 JO=0:RETURN
6000 IFJO=1THENGOTO200
6010 KO(O)=10
6015 L(O)=LE
6016 X=X+6:IFX>220THENX=30:Y=Y+50:IFY>170THENTM=1:TN=1
:GOSUB20
6020 CURSETX,Y+10,3:CHAR125,0,1
6025 O=O+1
6026 XX=X:YY=Y
6030 GOTO440
8000 IFX=XXANDY=YYANDJO<>1THENGOTO200
8010 FORI=XXTOXX+5
8020 CURSETI,YY-10,0:DRAW0,50,0
8030 NEXT
8040 FORI=YYTOYY+28STEP7
8050 CURSETXX,I,1:DRAW6,0,1
8060 NEXT
8065 XX=XX-6
8070 Y=YY:X=XX:O=O-1
8072 IFO=0THENGOTO8000
8075 IFL(O)=LE/OHTHENJO=1:PO=PO-1
8080 DE=1:GOTO200
```



PSEUDOSPRITES

A NUMBER OF home computers are now provided with sprite graphics, usually via special hardware such as the VIC chip in the Commodore 64. The ZX Spectrum unfortunately lacks such hardware, and so I have written a machine-code routine to emulate this feature. A sprite is a user-defined graphic character up to 16 by 16 points which can be positioned anywhere upon the screen and made to move very easily.

Normally a program in which a number of objects are required to move about the screen will be heavily involved in the mundane operations of erasing at the old position, updating co-ordinates, printing at the new position, checking for collisions, testing for the edge of the screen etc. One advantage of sprite graphics is that all of these operations are carried out automatically by the sprite mover routine, so that your program is free to get on with its other tasks.

The routine can handle up to eight sprites at a time. Associated with each sprite is a set of attributes which tell the routine how far to move the sprite at each step, how fast to move it, how many moves to make, and what to do if the sprite hits the edge of the screen or another object.

Each sprite has a collision flag which can be tested to check whether it has hit anything. Movement of the sprites is made independent of the user program because the machine-code routine is driven by interrupts.

Every 1/50 second the Z-80 microprocessor receives an interrupt which makes it stop whatever it is doing and carry out an interrupt service routine which normally just increments system variable frames and scans the keyboard. However, the interrupt can be diverted — as described by Nigel Dore in the May 1983 issue of *Your Computer* — and in this case it is made to include the sprite mover routine.

By doing this, your Basic program will be slowed down somewhat, according to how many sprites are being moved, and how fast they are moving. In spite of this, a program which uses sprite graphics will run faster than one which relies upon normal printing to achieve the same effects.

The machine code, sprite attributes and graphics characters occupy about 1.4K, and I have chosen to locate them below the Sinclair user-graphics. The machine code — listing 1 or 2 depending upon memory size — can be entered via the program in listing 3.

Take care, since a single mistake in the

Listing 1. Machine-code dump — 16K.

42	135	126	34	147	126	58	126
126	50	144	126	221	70	14	197
58	144	126	254	255	32	4	221
54	19	175	56	125	126	50	143
126	42	147	126	66	35	94	35
34	147	126	237	75	143	126	205
170	34	50	140	126	50	145	126
47	230	7	60	50	142	126	50
145	126	221	134	16	50	143	126
221	54	16	0	205	169	124	237
75	143	126	175	50	140	126	50
141	126	221	54	17	0	205	170
34	78	205	193	124	56	143	126
198	8	50	143	126	237	75	143
126	205	170	34	56	145	126	50
142	126	50	146	126	50	141	126
221	54	15	0	78	205	182	124
221	53	19	193	16	129	201	78
58	140	126	254	0	40	5	203
1	61	32	251	58	142	126	254
0	40	53	254	6	32	21	122
221	203	24	70	32	4	47	161
24	6	161	196	0	125	122	177
79	83	113	201	203	35	203	16
56	4	203	1	24	15	221	203
24	70	40	7	203	17	220	0
125	24	2	203	33	61	32	220
58	141	126	254	0	40	5	203
1	61	32	251	113	201	221	203
9	254	201	221	54	9	0	221
203	2	126	40	16	58	150	126
254	0	40	63	221	190	0	40
26	48	56	24	24	58	125	126
221	134	13	50	145	126	58	150
126	221	134	13	254	255	40	35
221	190	20	56	30	221	203	3
126	32	6	56	151	126	254	175
40	64	201	58	151	126	221	150
14	60	254	0	40	52	254	176
48	45	201	221	203	9	198	221
203	5	70	32	216	175	221	203
2	126	32	5	62	255	221	150
13	50	150	126	221	200	5	78
32	6	175	50	132	126	24	169
58	127	126	237	66	50	127	126
24	179	221	203	9	198	221	203
5	70	32	36	62	175	221	203
3	126	40	5	62	255	221	134
14	50	151	126	221	203	5	78
32	5	175	50	132	126	201	56
120	126	237	66	50	120	126	201
56	151	126	254	176	216	198	80
221	203	3	126	40	2	198	96
50	151	126	201	33	164	126	17
15	0	6	6	197	213	229	229
221	225	221	203	6	70	32	11
221	203	12	254	225	209	193	25
16	234	201	221	203	12	126	40
43	205	80	126	221	54	24	1
205	26	124	221	203	9	126	40
10	221	203	6	78	32	4	221
54	7	0	58	129	126	50	137
126	221	229	225	209	193	197	213
237	176	24	200	221	53	12	32
195	221	126	7	254	0	40	201
254	255	40	3	221	53	7	205
80	126	58	125	126	221	134	2
50	150	126	58	126	126	221	134
3	50	151	126	221	54	24	0
205	26	124	205	5	125	42	150
126	34	125	126	24	156	17	125
126	1	15	0	213	221	225	237
176	201	243	245	197	213	229	221
229	205	198	125	221	225	225	209
193	241	195	56	0	62	40	237
71	237	94	201	62	62	237	86
237	71	201					

Listing 2. Machine-code dump — 48K.

42	140	254	34	160	254	58	139
254	50	157	254	221	70	14	197
58	157	254	254	255	32	4	221
54	19	175	56	138	254	50	156
254	42	160	254	66	35	94	35
34	160	254	237	75	158	254	205
170	34	50	153	254	50	158	254
47	230	7	60	50	155	254	50
159	254	221	134	16	50	156	254
221	54	16	0	205	182	252	237
75	156	254	175	50	153	254	50
154	254	221	54	17	0	205	170
34	78	205	206	252	56	156	254
198	8	50	156	254	237	75	156
254	205	170	34	56	156	254	50
155	254	56	159	254	50	154	254
221	54	15	0	78	205	195	252
221	53	19	193	16	129	201	78
58	153	254	254	0	40	5	203
1	61	32	251	58	155	254	254
0	40	53	254	6	32	21	122
221	203	24	70	32	4	47	161
24	6	161	196	13	253	122	177
79	83	113	201	203	35	203	16
56	4	203	1	24	15	221	203
24	70	40	7	203	17	220	13
253	24	2	203	33	61	32	220
58	154	254	254	0	40	5	203
1	61	32	251	113	201	221	203
9	254	201	221	54	9	0	221
203	2	126	40	16	58	163	254
254	0	40	63	221	190	0	40
26	48	56	24	24	58	138	254
221	134	13	50	158	254	58	163
254	221	134	13	254	255	40	35
221	190	20	56	30	221	203	3
126	32	6	56	164	254	254	175
40	64	201	58	164	254	221	150
14	60	254	0	40	52	254	176
48	45	201	221	203	9	198	221
203	5	70	32	216	175	221	203
2	126	32	5	62	255	221	150
13	50	163	254	221	203	5	78
32	6	175	50	145	254	24	169
58	140	254	237	68	50	140	254
24	179	221	203	9	198	221	203
5	70	32	36	62	175	221	203
3	126	40	5	62	255	221	134
14	50	164	254	221	203	5	78
32	5	175	50	145	254	201	58
141	254	237	68	50	141	254	201
58	164	254	254	176	216	198	80
221	203	3	126	40	2	198	96
50	164	254	201	33	176	254	17
15	0	6	8	197	213	229	229
221	225	221	203	6	70	32	11
221	203	12	254	225	209	193	25
16	234	201	221	203	12	126	40
43	205	93	254	221	54	24	1
205	39	252	221	203	9	126	40
10	221	203	6	70	32	4	221
54	7	0	58	142	254	50	150
254	221	229	225	209	193	197	213
237	176	24	200	221	53	12	32
195	221	126	7	254	0	40	201
254	255	40	3	221	53	7	205
93	254	58	138	254	221	134	2
50	163	254	58	139	254	221	134
3	50	164	254	221	54	24	0
205	39	252	205	16	253	42	163
254	34	138	254	24	156	17	138
254	1	15	0	213	221	225	237
176	201	243	245	197	213	229	221
229	205	211	253	221	225	225	209
193	241	195	56	0	62	9	237
71	237	94	201	62	62	237	86
237	71	201					

Listing 3. Machine-code loader.

```
  10 CLEAR 31199+(PEEK 23733=255
) *32800
  20 LET K48=PEEK 23733=255
  30 LET st=31770+K48*32781
  40 FOR j=st TO st+610
  50 INPUT n: POKE j,n: PRINT n
  60 NEXT j
  70 PRINT "ADDRESS contents"
  80 FOR j=st TO st+610
  90 PRINT j;TAB 10;PEEK j
 100 NEXT j
```

machine code will almost certainly make the computer crash when you try to run it. Check the data after entry — you can make a note of any mistakes and correct them with a Poke — and Save the routine with the command:

SAVE "spmov48k" CODE 64551,611

or

SAVE "spmov16K" CODE 31770,611

You can now enter the sprite demonstration program in listing 4. This sets up the graphic character and programs the sprite attributes so that the eight sprites move away from the centre of the screen in random directions with different speeds.

At first they will bounce off the edges of the screen, but by pressing Enter you can make them wrap-around. Thus a sprite disappearing off the left hand edge of the screen will reappear at the right hand side. Then, by pressing Enter again you can make them stop moving as soon as they collide with each other.

I will now explain how to use the routine in your own programs. To do so, you need to Poke values into two areas of memory — the graphic character and sprite attribute areas.

In the graphics area you can store up to 16 different user-defined graphics, each made up of 16 by 16 points. When designing your characters you will need to use a grid.

If your character does not fill the grid, make sure that the unused areas come at the right hand side and the bottom, and make a note of the area that you have used — width × height — because you will need these values later. Now divide each line of the grid into two halves The left-hand group gives you a value for the first byte of data for each line, the right hand group gives the second data byte.

Chapter 14 of the user manual tells you how to work out the value for each byte. You can either work with binary numbers or convert to decimal.

Each character takes up 32 bytes, and these should be stored line by line, with the top line first. As stated earlier, the graphics area can hold 16 characters. On the 48K machine character number 1 would be stored in addresses 64000 — 64031, character 2 from 64032 — 64063 etc.

In order to simplify the process of designing your sprite graphic characters, I have written the Basic program in listing 5. This program lets you design your sprite graphics, store them in the graphics area of memory, retrieve characters from memory and edit them, and Save your sprite graphics to tape.

The cursor keys are used to move around with the 16 by 16 grid, and by pressing I you can ink in a particular square. Pressing P will change an inked square back to paper. At the right hand side of the screen, the contents of the graphics area is displayed so that you can see all the characters that you have set up.

The sprite attribute area consists of eight sets of 15 bytes. On the 48K machine the attributes for sprite 1 are stored from 65200 to 65214, sprite 2 from 65215 to 65229 etc. The meaning of each byte is described below addresses given are for sprite 1 add 15 for sprite 2, 30 for sprite 3 etc.

X position (65200/32420): This is the x co-ordinate of the top left hand corner of the sprite. Values range from 0 to 255. You should set this to wherever you wish the sprite to appear. Once the sprite starts moving the value is updated to reflect its actual position.

Y position (65201/32421): Y co-ordinate of the top left hand corner of the sprite. Possible values range from 0 to 175.

X movement (65202/32422): This tells the routine how many points to move the sprite in the X direction at each step. Values up to 127 move it from left to right. Values from 128 to 255 move it right to left, but the value is interpreted in 2's complement — so 255 means -1, 254 means -2 etc. If you are unsure of 2's complements, you can use negative numbers in a Poke statement to obtain the correct value — thus POKE 65202,-2. To avoid jerky motion I would advise you to use values between -10 and +10.

Y movement (65203/32423): As above, but for displacements in the Y direction. Positive values move it upwards, negative ones downwards.

Speed (65204/32424): This tells the routine how many interrupts should occur before the sprite is moved. Values may range from 1 to 255, and low values give fastest motion. Too low a value might make the sprite flicker, however.

Edge action (65205/32425): This tells the routine what to do when the sprite hits the edge of the screen: 0 = stop moving; 1 = continue, with wrap-around; 2 = bounce.

Collision action (65206/32426): This tells the routine what to do when the sprite hits another object: 0 = stop moving; 1 = continue moving.

Number of move (65207/32427Z): Values from 1 to 254 will move the sprite by that

(continued on next page)

(continued from previous page)

many steps. A value of 0 means that the sprite remains stationary. A value of 255 means keep moving continually. However, if the sprite hits the edge of the screen when edge action = 0 or another object when collide action = 0, the sprite will stop and the number of moves will be set to 0.

Off/on (65208/32428): A value of 0 means that the sprite is switched off. A value of 1 switches it on. You should only switch a sprite on after all its other attributes have been set.

Collision flag (65209/32429): This byte can be Peeked, and it returns values of : 0 = no collision; 1 = sprite is at the edge of the screen; 128 = sprite has hit another object; 129 = sprite is at edge, and has hit something.

Graphic character address (65210, 11/32430,31): These two bytes contain the address where the sprite graphic character is stored. 65210/32430 contains the low byte of the address i.e., remainder from (address/256), 65231/32431 contains the high byte i.e., INT(address/256).

65212/32432: This byte is used by the mover routine and should not be Poked.

Width (65213/32433): This tells the routine how wide — 1 to 16 points — the sprite graphic character is. It needs to know this so as to tell when it has reached the edge.

Height (65214/32434): This tells the routine how many lines you have used in the sprite graphic character — 1 to 16 — so that it knows when it hits the bottom of the screen.

After setting up your graphics characters and attributes, you can switch on the sprite mover routine with the command:

RAND USR 65148 (or 32367)

This diverts the interrupt service routine so as to include the machine code. Sprites can be switched off, and interrupts restored to normal with RAND USR 65155 (or 32374)

There is no provision within the routine for selecting sprite colours. Instead, the sprites are printed in Ink 9, Paper 9 — they take their colour from whatever is already on the screen. For example, when passing over an area of the screen which had been printed in blue ink on yellow paper, the sprite would appear blue. Note also that while sprites are switched on, you can clear the screen without erasing the sprites. You can use this fact to change sprite colours as is done in the demonstration program in listing 4.

This routine offers a number of advantages to Basic programmers, providing features which can only be obtained from machine code. The speed of movement and ability to use high resolution graphics mean that arcade action games can now be written in Basic.

If anyone would like a cassette tape which contains a copy of the machine code and sprite graphic character generator, together with a number of demonstration programs, they should send £3 to 47 Wellingborough Road, Broughton, Kettering, Northants. ■

Listing 4. Sprite demonstration.

```
  10 REM ** sprite demo ********
  20 LET k48=PEEK 23733=255
  30 LET sg=31200+k48*32800: REM
 start of graphics area
  40 LET sa=32420+k48*32700: REM
 start of attributes area
  50 LET spon=32367+k48*32781 :
REM address to switch on sprite
mover routine
  60 LET spoff=spon+7: REM
address to restore normal
interrupts
  70 REM *** set up graphic 1 **
  80 FOR j=sg TO sg+31
  90 READ n: POKE j,n
 100 NEXT j
 110 DATA 192,12,32,16,19,32,63,
240,84,168,247,168,95,232,60,240
,24,96,0,0,0,0,0,0,0,0,0,0,0,0,0
,0
 120 BORDER 1: PAPER 4: INK 1: C
LS
 130 RANDOMIZE 0
 140 REM *** set up attributes *
 150 FOR j=sa TO sa+105 STEP 15
 160 POKE j,100: REM x position
 170 POKE j+1,100: REM y posn
 180 POKE j+2,1+RND*3: REM
random x movement
 190 POKE j+3,1+RND*4: REM
random y movement
 200 POKE j+4,1+RND*4: REM
random speed
 210 POKE j+5,2: REM edge action
=bounce
 220 POKE j+6,1: REM collision
action = continue
 230 POKE j+7,255: REM continual
 movement
 240 POKE j+8,1: REM sprite on
 250 POKE j+10,sg-256*INT (sg/25
6): REM low byte of address for
graphic number 1
 260 POKE j+11,INT (sg/256): REM
 high byte of address
 270 POKE j+13,13: REM width
 280 POKE j+14,9: REM ht
 290 NEXT j
 300 RANDOMIZE USR spon: REM **
divert interrupts to include
sprite mover routine
 310 INPUT "ENTER to see wrap ar
ound";a$
 320 PAPER 0: INK 2: BORDER 4: C
LS : REM CLS does not erase
active sprites
 330 FOR j=sa+5 TO sa+110 STEP 1
5
 340 POKE j,1: REM edge action=1
 350 NEXT j
 360 INPUT "ENTER for stop at co
llision";a$
 370 PAPER 5: INK 0: BORDER 2: C
LS
 380 FOR j=sa+6 TO sa+111 STEP 1
5
 390 POKE j,0: REM set collide
action=0 (stop)
 400 NEXT j
 410 REM when all sprites have
  stopped restore interrupts to
  normal
 420 LET c=0
 430 FOR j=sa+9 TO sa+114 STEP 1
5
 440 IF PEEK j>127 THEN LET c=c+
1
 450 NEXT j
 460 IF c<6 THEN GO TO 420
 470 RANDOMIZE USR spoff
```

Example screen.

```
The arrow keys move cursor (+)
I = ink.          P = paper.
G = get graphic.  C = clear grid
S = store grid.   T = tape save.
Z = stop.
                    GRAPHIC AREA
                    1  2  3  4

                    5  6  7  8

                    9  10 11 12

                    13 14 15 16
```

Listing 5.

```
  10 REM ************************
  20 REM sprite designer program
     © Robert Newman Sep 1983
  30 REM
  40 REM ************************
  50 LET K48=PEEK 23733=255
  60 LET sc=31200+K48*32800
  70 DIM a(8)
 100 POKE USR "a",255
 110 FOR J=1 TO 7: POKE USR "a"+
j,1: NEXT j
 120 POKE USR "b"+1,0
 130 FOR j=2 TO 6: POKE USR "b"+
j,16: NEXT j
 140 POKE USR "b"+4,124
 200 INK 0: PAPER 6: BORDER 3: C
LS
 210 PRINT "This program lets yo
u design    sprite graphic chara
cters and   store them in the me
mory, and ontape."
 220 PRINT '"You can also get ch
aracters frommemory and edit the
m."
 230 PRINT '"Keys to use are sho
wn at the topof the next screen.
"
 240 PRINT '"Before starting, do
 you want to load a set of chara
cters from    tape?"
 250 INPUT "y/n? ";a$
 260 IF a$<>"y" AND a$<>"Y" THEN
 GO TO 1000
 270 LOAD ""CODE sc
1000 REM ** sprite designer ****
1005 BORDER 6: INK 0: PAPER 4: C
LS
1010 GO SUB 1800: GO SUB 4000
1020 PRINT AT 0,0;"The arrow key
s move cursor (+)   I = ink.
    P = paper."
1030 PRINT "G = get graphic. C =
 clear grid S = store grid.  T =
 tape save."
1035 PRINT "Z = stop."
1040 RESTORE 1060
1050 FOR j=1 TO 8: READ a(j): NE
XT j
1060 DATA 255,254,253,251,247,23
9,243,235
1070 IF IN 61438<223 THEN FOR j=
1 TO 8: LET a(j)=a(j)-64: NEXT j
1100 IF IN 65278=a(1) AND IN 650
22=a(1) AND IN 64510=a(1) AND IN
 63486=a(1) AND IN 61438=a(1) AN
D 57342=a(1) THEN GO TO 1100
1105 IF IN 65278=a(3) THEN STOP
1110 IF IN 64510=a(6) THEN GO SU
B 3000
1120 IF IN 65278=a(5) THEN GO SU
B 1800
1130 IF IN 65022=a(6) THEN GO TO
 5000
1140 IF IN 65022=a(3) THEN GO TO
 6000
1150 LET x2=x1: LET y2=y1
1155 LET a=IN 57342
1160 IF a=a(4) OR a=a(7) OR a=a(
8) THEN PRINT AT y1,x1;"■";AT y1
,x1; OVER 1;"+": GO TO 1100
1170 IF a=a(2) THEN PRINT AT y1,
x1;"┬";AT y1,x1; OVER 1;"+"
1180 IF IN 63486=a(6) THEN LET x
2=x1-(x1<>0)
1190 LET a=IN 61438
1200 IF a=a(4) THEN LET x2=x1+(x
1<>15)
1210 IF a=a(5) THEN LET y2=y1-(y
1<>6)
1220 IF a=a(6) THEN LET y2=y1+(y
1<>21)
1230 IF a=a(7) THEN LET x2=x1+(x
1<>15): LET y2=y1-(y1<>6)
1240 IF a=a(8) THEN LET x2=x1+(x
1<>15): LET y2=y1+(y1<>21)
1250 IF x1<>x2 OR y2<>y1 THEN PR
INT AT y1,x1; OVER 1;"+";AT y2,x
2;"+"
1260 LET x1=x2: LET y1=y2
1270 GO TO 1100
1500 REM ************************
1800 FOR j=6 TO 21
1810 PRINT AT j,0;"┬┬┬┬┬┬┬┬┬┬┬┬┬
┬┬┬": NEXT j
1820 LET x1=0: LET y1=6
1830 PRINT AT y1,x1; OVER 1;"+"
1840 RETURN
3000 REM **** save sprites *****
3010 PRINT AT 5,0; PAPER 2; INK
7; FLASH 1;"Insert data tape."
3020 SAVE "spchars"CODE 31200+K4
8*32800,512
3030 PRINT AT 5,0;"
                "
3040 RETURN
4000 REM **** display sprites **
4005 PRINT AT 5,19; PAPER 1; INK
 7;"GRAPHIC AREA"
4010 LET no=1
4020 FOR a=6 TO 18 STEP 4
4030 FOR b=19 TO 28 STEP 3
4040 PRINT AT a,b;no: GO SUB 450
0
4050 LET no=no+1
4060 NEXT b
4070 NEXT a
4080 RETURN
4090 REM ************************
4500 LET ts=sc+(no-1)*32
4510 FOR z=0 TO 15
4520 POKE USR "c"+z,PEEK ts: LET
 ts=ts+1
4530 POKE USR "e"+z,PEEK ts: LET
 ts=ts+1
4540 NEXT z
4550 LET l=INT ((no-1)/4): LET c
=no-4*l
4560 LET l=(4*l)+7: LET c=(3*c)+
16
4570 PRINT AT l,c; PAPER 7; INK
0;"██";AT l+1,c;"  "
4580 RETURN
4590 REM ************************
5000 REM *** get graphic *******
5010 PRINT AT y1,x1; OVER 1;"+"
5020 INPUT "Get which graphic(1
-16)? ";no
5030 IF no<1 OR no>16 THEN GO TO
 5020
5040 LET ts=sc+(no-1)*32
5050 FOR j=6 TO 21
5060 PRINT AT j,0;"┬┬┬┬┬┬┬┬┬┬┬┬┬
┬┬┬";AT j,0;
5070 FOR k=1 TO 2
5080 LET n=PEEK ts: LET b=128
5090 IF n=0 THEN GO TO 5150
5100 FOR a=1 TO 8
5110 IF n<b THEN PRINT "┬";: GO
TO 5130
5120 PRINT "■";: LET n=n-b
5130 LET b=b/2
5140 NEXT a
5150 LET ts=ts+1
5160 NEXT k
5170 NEXT j
5180 LET x1=0: LET y1=6: PRINT A
T y1,x1; OVER 1;"+"
5190 GO TO 1040
5300 REM ************************
6000 REM **** store grid *******
6010 PRINT AT y1,x1; OVER 1;"+"
6020 INPUT "Store in which graph
ic(1-16)?";no
6030 IF no<1 OR no>16 THEN GO TO
 6020
6040 PRINT AT 5,2; PAPER 2; INK
7; FLASH 1;"PLEASE WAIT"
6050 LET ts=sc+(no-1)*32
6060 FOR y=122 TO 2 STEP -8
6070 FOR k=0 TO 1
6080 LET n=128: LET b=0
6090 FOR x=64*k TO 56+(64*k) STE
P 8
6100 LET b=b+POINT (x,y)*n: LET
n=n/2
6110 NEXT x
6120 POKE ts,b: LET ts=ts+1
6130 NEXT k
6140 NEXT y
6150 GO SUB 4500
6160 PRINT AT y1,x1; OVER 1;"+"
6170 PRINT AT 5,2;"
            "
6180 GO TO 1040
6190 REM ************************
```

NB. In line 4570, the graphics characters are "CE" ,then "DF".

Step into the third dimension

Take a giant step closer to reality with New Generation Software. The 3D Graphics of New Generation programs bring the screen alive and makes other games look as flat as snakes and ladders.

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DE MUUR — Dutch for the Wall — is an arcade type machine code game. You are the commander of a starcruiser and you have to shoot your way through the defences of your enemy. Your arms? A powerful laser-gun and plenty of energy! You can use a joystick or the keyboard to control your starcruiser. Both allow very quick reactions. Fire as fast as you can using either the joystick button or one of the keys.

If you can avoid all the enemy bombs and shoot a gap the size of your cruiser in the wall before it crushes you, you will take off to another level — even more difficult and faster. After the fifth level, the program does not speed up anymore. You can, however, change this by replacing the 4 in 390 by another number.

I do not think the game is too easy. On the contrary! It is a marvelous test for your reflexes. The game itself is completely written in machine code and uses highly detailed graphics — PMode 4 — and sound effects. You start with three starcruisers but you receive an extra one at the 6000 points' score.

The number of cruisers left and your level are indicated on top of the screen. If you cleared one level, the program returns for a short while to Basic to show your score. The program keeps track of five high scores. Each new level means 1000 points bonus for you. A hole in the wall is worth 2 points; destroying a bomb 10 points.

If you use the keyboard, you can control your star-cruiser with the arrow keys but if you want some other keys for movement, just define them. Use the list of ASCII codes in the manual on page 136. Poke the values you want — from the column "with shift key" — in 32277 = left and 32284 = right. e.g., Q and W would result in this extra line:

```
105 POKE 32277,81:POKE 32284,87
```

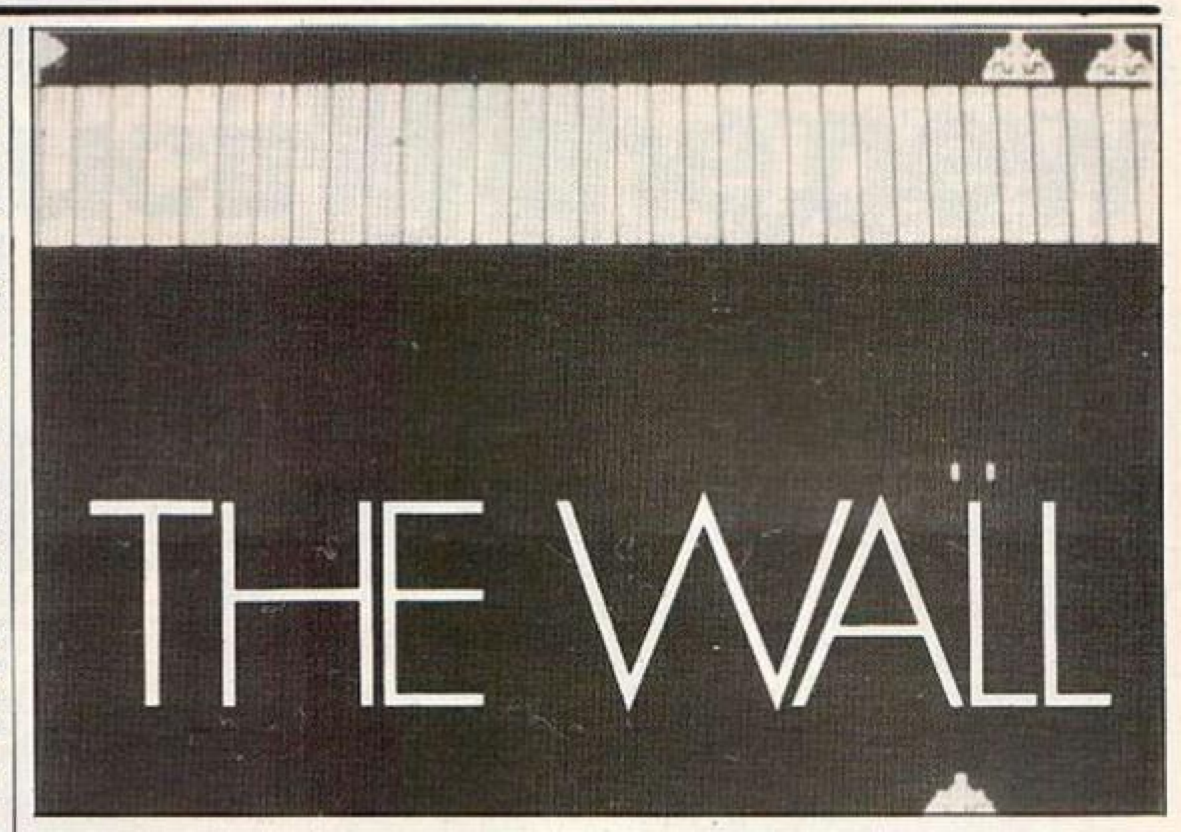
All the keys which aren't used for movement will fire your laser gun. You can also change the speed of the downcoming wall by replacing 37 in line 160. The higher the number, the slower the wall comes down.

To enter this game, first type in the small Basic listing and Save it on tape. Then type in the long machine-code listing which contains the game in the form of data statements. If you entered it completely just run it. The program will warn you if you made an error and will give you the line number of the incorrect line.

If no error messages appear on your screen and if you see the word 'Done' then you can Save the game on tape behind the Basic listing you already Saved. To do this use:

```
CSAVEM"WALL",31060,32760,0
```

To be sure in case of any undetected errors; Save the Basic loading program somewhere on tape. If you followed these instructions, then you can load the Basic program of Wall — De Muur — and run it. If everything works fine, you will be at the controls of your star-cruiser ready to fight. You can break out of the program at any moment by pressing the Reset button.



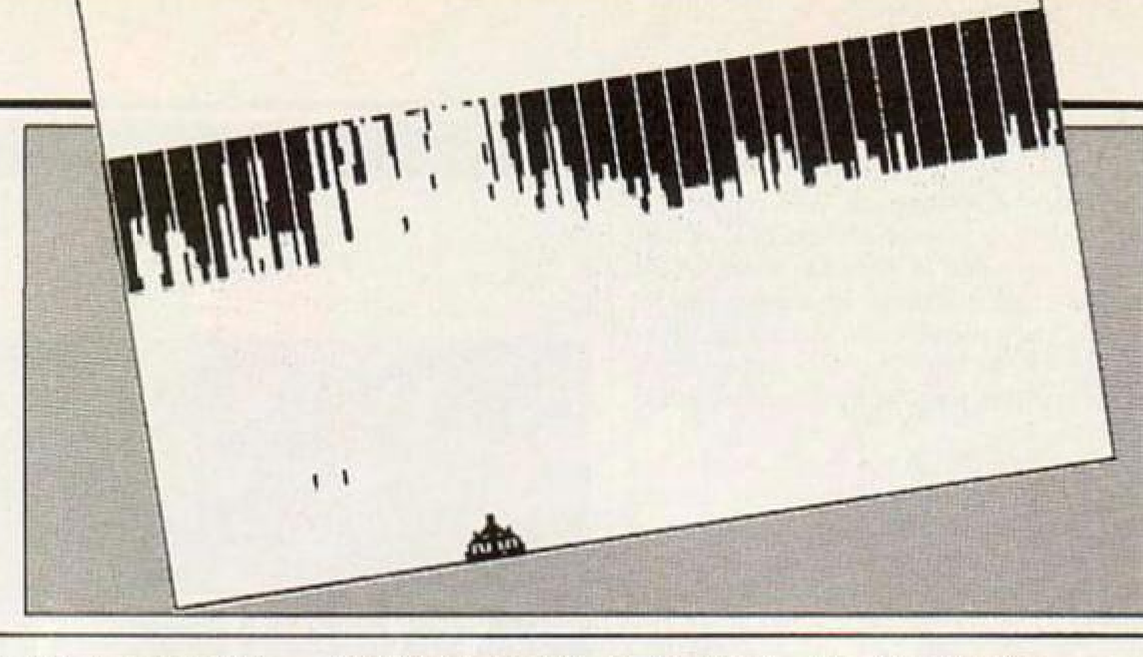
T Fiers crashes through another brick in the wall.

(continued on next page)

Basic listing.

```
10 '***********************
20 '***                 ***
30 '***    DE MUUR      ***
40 '***                 ***
50 '***    T.FIERS      ***
60 '***  1983  BELGIUM  ***
70 '***********************
80 CLEAR1000,31000:PCLEAR5
90 CLS:PRINT@70,"DE MUUR";:PRINT@192,"READING MACHINE LANGUAGE PART...":PRINT@43
7,"T.FIERS 1983":SCREEN0,1
100 CLOADM
110 CLS2:PRINT@225,"";:INPUT" KEYBOARD OR JOYSTICK (K/J)";A$
120 IF A$="K"THEN 410 ELSE 420
130 A1=0:A2=0:A3=0:A4=0:A5=0:A6=0
140 '***new*game***
150 A1=0:F=1:POKE31998,1:POKE31997,0:POKE32003,0:POKE32004,0:POKE32005,3
160 POKE32008,37:IF A$="K"THEN POKE32043,0:POKE31996,6 ELSE POKE 32043,1:POKE319
98,7
170 '***new*level***
180 POKE32050,1:POKE32814,0:POKE32815,0:POKE32005,0:POKE31035,0
190 GOSUB 360:PMODE4,1:PCLS:SCREEN1,1:EXEC31100
200 IF PEEK(32050)=0 THEN 180
210 '***score***
220 A1=PEEK(32003)*256+PEEK(32004)
230 SCREEN0,0:CLS RND(8):PRINT@40,"FINAL SCORE WAS";A1;
240 IF A1>A6 THEN PRINT@96,"";:INPUT"YOUR NAME";A$ ELSE 270
250 IF A1>A2 THEN A6=A5:A5=A4:A4=A3:A3=A2:A2=A1:F$=E$:E$=D$:D$=C$:C$=B$:B$=A$:G
OTO270 ELSE IF A1>A3 THEN A6=A5:A5=A4:A4=A3:A3=A1:F$=E$:E$=D$:D$=C$:C$=A$:GOTO27
0 ELSE IF A1>A4 THEN A6=A5:A5=A4:A4=A1:F$=E$:E$=D$:D$=A$:GOTO270
260 IF A1>A5 THEN A6=A5:A5=A1:F$=E$:E$=A$:GOTO270 ELSE A6=A1:F$=A$
270 PRINT@170,A2" BY "B$;:PRINT@234,A3;" BY "C$;:PRINT@298,A4;" BY ";D$;:PRINT@3
62,A5;" BY ";E$;:PRINT@426,A6;" BY ";F$;
280 PRINT@480,"ANOTHER GAME  (Y OR N) ?";
290 SCREEN0,1
300 A$=INKEY$:IF A$="" THEN 320
310 IF A$="N"THENCLS:END ELSE 150
320 READZ$:IF Z$="ZZ"THEN RESTORE:GOTO320
330 PLAY Z$:GOTO300
340 DATA O2E,F,E,C,O1,B,O2C,D,E,D,E,D,C,D,C,O1B,ZZ
350 '***print*level*score***
360 SCREEN0,0:CLSF:PRINT@170,"LEVEL ";PEEK(31998);:PRINT@327+32,"SCORE IS ";PEEK
(32003)*256+PEEK(32004);
370 F=F+1:IF F=5 THENF=1
380 IF PEEK(32008)<15 THEN POKE32008,14
390 SCREEN0,1:IF PEEK(31998)<4 THEN POKE31996,PEEK(31996)-1
400 PLAY"O2T5V15CV10CV5CP100V15FV10FV5FP200V15EV15EV5EP200V15DV10DV5DV15FV10FV5F
P200V15AV10AV5AO3P100V15CV10CV5CV2CV10":RETURN
410 CLS2:PRINT@160,"KEYBOARD VERSION";:PRINT@225,"THE ARROW KEYS CONTROL YOUR  "
;:PRINT@257,"MOVEMENT. ANY OTHER KEY FIRES";:PRINT@289,"THE LASER GUN OF YOUR BA
SE . ";
420 PRINT@70,"GOOD LUCK";:PRINT@453,"PRESS ANY KEY TO START";
430 SCREEN0,1
440 IF INKEY$=""THEN440ELSE130
450 END
```

(continued from previous page)



Machine code listing.

```
10 '### DE MUUR T.FIERS M/C ###
20 '
30 F=0:CLS
40 CLEAR1000,31000:PCLEAR5
50 FOR T=31060 TO 32750 STEP10
60 FOR T1=0 TO 9
70 READ H
80 POKE T+T1,H
90 F=F+H
100 NEXT T1
110 READ H2
120 IF H2<>F THEN 150
130 F=0:NEXT T
140 CLS:PRINT"DONE.":END
150 D=PEEK(&H31)*256+PEEK(&H32)
160 PRINT:PRINT"ERROR IN LINE "D
170 END
```

```
200 DATA 121 , 98 , 224 , 224 , 224 , 224 , 224 , 224 , 224 , 224 , 2009
210 DATA 16 , 64 , 2 , 16 , 1 , 32 , 8 , 8 , 1 , 32 , 180
220 DATA 32 , 8 , 1 , 128 , 128 , 1 , 32 , 4 , 4 , 8 , 348
230 DATA 16 , 224 , 224 , 224 , 224 , 224 , 224 , 224 , 224 , 224 , 2032
240 DATA 142 , 7 , 128 , 191 , 125 , 1 , 134 , 254 , 187 , 128 , 1277
250 DATA 140 , 12 , 8 , 38 , 249 , 142 , 4 , 126 , 191 , 125 , 1027
260 DATA 18 , 182 , 125 , 6 , 128 , 7 , 129 , 1 , 34 , 2 , 624
270 DATA 134 , 6 , 183 , 125 , 6 , 134 , 15 , 183 , 125 , 8 , 921
280 DATA 189 , 125 , 65 , 127 , 125 , 7 , 127 , 125 , 54 , 190 , 1134
290 DATA 125 , 7 , 48 , 137 , 28 , 127 , 189 , 122 , 136 , 182 , 1101
300 DATA 124 , 234 , 183 , 125 , 88 , 142 , 6 , 0 , 55 , 16 , 1005
310 DATA 142 , 127 , 58 , 123 , 5 , 37 , 8 , 16 , 142 , 127 , 784
320 DATA 38 , 128 , 4 , 183 , 125 , 60 , 166 , 160 , 167 , 132 , 1163
330 DATA 48 , 137 , 0 , 32 , 92 , 193 , 12 , 37 , 243 , 48 , 842
340 DATA 137 , 254 , 129 , 16 , 142 , 127 , 58 , 122 , 125 , 60 , 1162
350 DATA 182 , 125 , 60 , 33 , 3 , 55 , 32 , 224 , 32 , 30 , 822
360 DATA 142 , 0 , 0 , 16 , 190 , 125 , 7 , 49 , 169 , 28 , 726
370 DATA 127 , 204 , 0 , 0 , 237 , 164 , 49 , 169 , 0 , 32 , 982
380 DATA 48 , 137 , 0 , 1 , 140 , 0 , 12 , 38 , 241 , 57 , 674
390 DATA 189 , 128 , 18 , 182 , 125 , 49 , 39 , 73 , 182 , 1 , 986
400 DATA 98 , 129 , 58 , 34 , 6 , 129 , 5 , 37 , 32 , 32 , 552
410 DATA 116 , 190 , 125 , 7 , 140 , 0 , 31 , 36 , 108 , 189 , 942
420 DATA 121 , 244 , 190 , 125 , 7 , 48 , 137 , 0 , 1 , 191 , 1064
430 DATA 125 , 7 , 48 , 137 , 28 , 127 , 189 , 122 , 136 , 32 , 951
440 DATA 86 , 190 , 125 , 7 , 140 , 0 , 1 , 35 , 78 , 189 , 851
450 DATA 121 , 244 , 190 , 125 , 7 , 48 , 137 , 255 , 255 , 191 , 1573
460 DATA 125 , 7 , 48 , 137 , 28 , 127 , 189 , 122 , 136 , 32 , 951
470 DATA 56 , 127 , 125 , 48 , 189 , 187 , 229 , 16 , 142 , 255 , 1374
480 DATA 255 , 16 , 191 , 1 , 60 , 16 , 191 , 1 , 92 , 16 , 849
490 DATA 191 , 1 , 84 , 16 , 191 , 1 , 86 , 16 , 191 , 1 , 778
500 DATA 88 , 126 , 126 , 20 , 39 , 161 , 32 , 19 , 16 , 142 , 769
510 DATA 125 , 20 , 236 , 161 , 237 , 132 , 48 , 137 , 0 , 32 , 1128
520 DATA 16 , 140 , 125 , 44 , 38 , 242 , 57 , 189 , 122 , 160 , 1133
530 DATA 32 , 189 , 124 , 125 , 16 , 182 , 125 , 16 , 129 , 10 , 868
540 DATA 37 , 31 , 127 , 125 , 16 , 16 , 190 , 125 , 1 , 49 , 717
550 DATA 169 , 4 , 126 , 236 , 164 , 73 , 137 , 0 , 93 , 201 , 1199
560 DATA 0 , 237 , 164 , 49 , 169 , 255 , 254 , 16 , 188 , 125 , 1457
570 DATA 1 , 36 , 236 , 246 , 125 , 3 , 92 , 241 , 125 , 6 , 1117
580 DATA 36 , 4 , 247 , 125 , 3 , 57 , 35 , 247 , 125 , 3 , 354
590 DATA 150 , 125 , 1 , 49 , 137 , 4 , 126 , 16 , 174 , 132 , 950
600 DATA 16 , 175 , 137 , 0 , 32 , 48 , 137 , 255 , 254 , 188 , 1242
610 DATA 125 , 1 , 36 , 239 , 79 , 16 , 142 , 0 , 0 , 190 , 828
620 DATA 125 , 1 , 16 , 175 , 129 , 76 , 129 , 16 , 37 , 248 , 952
630 DATA 190 , 125 , 1 , 49 , 137 , 0 , 32 , 191 , 125 , 1 , 850
640 DATA 57 , 16 , 150 , 125 , 14 , 16 , 140 , 0 , 0 , 38 , 556
650 DATA 44 , 16 , 190 , 125 , 1 , 49 , 169 , 4 , 127 , 16 , 741
660 DATA 140 , 21 , 124 , 16 , 36 , 0 , 150 , 190 , 121 , 84 , 882
670 DATA 166 , 128 , 140 , 121 , 114 , 37 , 3 , 142 , 121 , 94 , 1066
680 DATA 191 , 121 , 84 , 189 , 124 , 255 , 189 , 125 , 0 , 232 , 1510
690 DATA 125 , 7 , 250 , 125 , 45 , 232 , 125 , 1 , 195 , 4 , 1132
700 DATA 127 , 243 , 125 , 45 , 243 , 125 , 14 , 31 , 1 , 16 , 970
710 DATA 190 , 125 , 14 , 16 , 140 , 0 , 0 , 39 , 25 , 204 , 753
720 DATA 0 , 0 , 237 , 137 , 0 , 32 , 237 , 132 , 237 , 137 , 1149
730 DATA 255 , 224 , 237 , 137 , 255 , 192 , 237 , 137 , 255 , 160 , 2089
740 DATA 237 , 137 , 255 , 128 , 252 , 124 , 255 , 237 , 137 , 0 , 1762
750 DATA 32 , 237 , 137 , 0 , 64 , 237 , 137 , 0 , 96 , 207 , 1177
760 DATA 137 , 0 , 128 , 31 , 16 , 49 , 169 , 0 , 128 , 16 , 676
770 DATA 140 , 29 , 76 , 37 , 30 , 16 , 142 , 0 , 0 , 16 , 486
780 DATA 175 , 137 , 0 , 32 , 16 , 175 , 137 , 0 , 64 , 16 , 752
790 DATA 175 , 137 , 0 , 96 , 16 , 175 , 137 , 0 , 128 , 16 , 880
800 DATA 151 , 125 , 14 , 32 , 12 , 16 , 190 , 125 , 14 , 49 , 768
810 DATA 169 , 0 , 128 , 16 , 151 , 125 , 14 , 142 , 0 , 0 , 785
820 DATA 48 , 137 , 0 , 1 , 166 , 124 , 252 , 37 , 247 , 190 , 1224
830 DATA 125 , 7 , 48 , 137 , 28 , 127 , 16 , 174 , 137 , 255 , 1054
840 DATA 224 , 16 , 140 , 0 , 0 , 39 , 3 , 126 , 126 , 62 , 736
850 DATA 16 , 150 , 125 , 1 , 16 , 140 , 24 , 0 , 37 , 3 , 552
860 DATA 126 , 127 , 63 , 232 , 125 , 3 , 16 , 131 , 29 , 112 , 978
870 DATA 37 , 57 , 16 , 131 , 27 , 0 , 34 , 51 , 195 , 3 , 551
880 DATA 232 , 253 , 125 , 3 , 124 , 125 , 5 , 189 , 125 , 65 , 1246
890 DATA 127 , 125 , 47 , 134 , 63 , 189 , 255 , 35 , 127 , 255 , 1351
900 DATA 32 , 134 , 255 , 115 , 255 , 32 , 31 , 137 , 90 , 38 , 1119
910 DATA 253 , 74 , 38 , 245 , 134 , 55 , 189 , 255 , 35 , 124 , 1356
920 DATA 125 , 47 , 182 , 125 , 47 , 129 , 5 , 37 , 220 , 182 , 1099
930 DATA 125 , 49 , 39 , 39 , 182 , 125 , 48 , 246 , 255 , 0 , 1102
940 DATA 193 , 255 , 38 , 6 , 127 , 125 , 48 , 126 , 122 , 18 , 1058
950 DATA 193 , 127 , 38 , 6 , 127 , 125 , 48 , 126 , 122 , 18 , 930
960 DATA 129 , 0 , 39 , 13 , 126 , 122 , 18 , 126 , 126 , 40 , 739
970 DATA 129 , 0 , 38 , 3 , 126 , 0 , 18 , 134 , 1 , 183 , 632
980 DATA 125 , 48 , 190 , 125 , 7 , 48 , 137 , 28 , 63 , 16 , 787
990 DATA 190 , 125 , 1 , 49 , 169 , 4 , 126 , 236 , 132 , 16 , 1050
1000 DATA 131 , 0 , 0 , 38 , 39 , 138 , 1 , 202 , 128 , 237 , 914
1010 DATA 132 , 48 , 137 , 255 , 224 , 188 , 125 , 1 , 36 , 233 , 1379
1020 DATA 183 , 124 , 142 , 126 , 122 , 18 , 236 , 132 , 132 , 254 , 1475
1030 DATA 196 , 127 , 237 , 132 , 48 , 137 , 0 , 32 , 140 , 28 , 1077
1040 DATA 95 , 37 , 239 , 57 , 16 , 191 , 125 , 62 , 188 , 125 , 1135
1050 DATA 62 , 34 , 53 , 31 , 2 , 132 , 1 , 136 , 128 , 129 , 708
1060 DATA 1 , 39 , 16 , 193 , 128 , 39 , 12 , 236 , 132 , 16 , 812
1070 DATA 190 , 125 , 1 , 49 , 169 , 4 , 126 , 32 , 182 , 31 , 911
1080 DATA 32 , 16 , 190 , 125 , 3 , 49 , 169 , 0 , 2 , 10 , 602
1090 DATA 191 , 125 , 3 , 48 , 137 , 255 , 129 , 189 , 124 , 142 , 1342
1100 DATA 189 , 125 , 229 , 126 , 122 , 18 , 126 , 125 , 150 , 0 , 1212
1110 DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
1120 DATA 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0 , 0
1130 DATA 0 , 0 , 0 , 0 , 0 , 0 , 4 , 0 , 11 , 64 , 79
1140 DATA 64 , 24 , 0 , 66 , 128 , 1 , 7 , 0 , 17 , 0 , 307
1150 DATA 4 , 126 , 255 , 255 , 0 , 0 , 6 , 255 , 255 , 255 , 1411
1160 DATA 1 , 128 , 1 , 128 , 1 , 128 , 3 , 192 , 23 , 232 , 837
1170 DATA 23 , 152 , 63 , 252 , 63 , 162 , 65 , 170 , 209 , 139 , 1326
1180 DATA 255 , 255 , 248 , 31 , 255 , 0 , 8 , 5 , 0 , 1 , 1058
1190 DATA 1 , 255 , 255 , 10 , 0 , 24 , 176 , 255 , 255 , 255 , 1486
1200 DATA 0 , 255 , 28 , 96 , 0 , 126 , 126 , 249 , 204 , 0 , 1084
1210 DATA 0 , 237 , 129 , 140 , 7 , 128 , 37 , 249 , 142 , 125 , 1194
1220 DATA 28 , 16 , 142 , 6 , 38 , 182 , 125 , 5 , 129 , 4 , 659
1230 DATA 33 , 43 , 129 , 3 , 39 , 28 , 129 , 2 , 39 , 1 , 444
1240 DATA 57 , 236 , 129 , 237 , 164 , 49 , 169 , 0 , 32 , 16 , 1089
1250 DATA 140 , 7 , 115 , 35 , 242 , 57 , 236 , 129 , 237 , 164 , 1362
1260 DATA 237 , 169 , 255 , 250 , 49 , 169 , 0 , 32 , 16 , 140 , 1320
1270 DATA 7 , 115 , 35 , 238 , 57 , 236 , 129 , 237 , 164 , 237 , 1455
1280 DATA 169 , 255 , 250 , 237 , 169 , 255 , 250 , 49 , 169 , 0 , 1806
1290 DATA 32 , 16 , 140 , 7 , 115 , 35 , 234 , 57 , 132 , 1 , 769
1300 DATA 156 , 128 , 16 , 131 , 0 , 0 , 16 , 39 , 255 , 13 , 754
1310 DATA 204 , 0 , 0 , 253 , 124 , 255 , 253 , 125 , 14 , 16 , 1244
1320 DATA 142 , 0 , 0 , 16 , 175 , 137 , 255 , 160 , 167 , 137 , 1189
1330 DATA 255 , 159 , 48 , 137 , 0 , 32 , 92 , 193 , 12 , 37 , 965
1340 DATA 238 , 48 , 137 , 255 , 128 , 189 , 124 , 142 , 189 , 125 , 1575
1350 DATA 249 , 252 , 125 , 3 , 195 , 0 , 10 , 253 , 125 , 3 , 1215
1360 DATA 126 , 122 , 18 , 134 , 63 , 189 , 255 , 35 , 142 , 132 , 1216
1370 DATA 208 , 166 , 128 , 138 , 128 , 189 , 255 , 32 , 140 , 137 , 1515
1380 DATA 128 , 37 , 244 , 134 , 55 , 189 , 255 , 35 , 57 , 134 , 1262
1390 DATA 63 , 189 , 255 , 35 , 196 , 10 , 127 , 255 , 32 , 115 , 1273
1400 DATA 255 , 32 , 134 , 255 , 74 , 38 , 253 , 90 , 38 , 245 , 1414
1410 DATA 134 , 55 , 189 , 255 , 35 , 57 , 129 , 0 , 38 , 3 , 897
1420 DATA 126 , 122 , 63 , 129 , 9 , 38 , 3 , 126 , 122 , 39 , 783
1430 DATA 183 , 125 , 48 , 126 , 122 , 155 , 182 , 125 , 48 , 39 , 1159
1440 DATA 11 , 182 , 124 , 91 , 38 , 9 , 124 , 124 , 91 , 126 , 920
1450 DATA 124 , 93 , 127 , 124 , 91 , 126 , 122 , 18 , 127 , 125 , 1077
1460 DATA 53 , 134 , 63 , 189 , 255 , 35 , 198 , 2 , 127 , 255 , 1309
1470 DATA 32 , 115 , 255 , 32 , 134 , 255 , 74 , 38 , 253 , 90 , 1278
1480 DATA 38 , 245 , 134 , 55 , 189 , 255 , 35 , 142 , 6 , 0 , 1099
1490 DATA 166 , 132 , 67 , 167 , 128 , 140 , 30 , 20 , 37 , 246 , 1133
1500 DATA 124 , 125 , 53 , 248 , 125 , 53 , 193 , 10 , 37 , 207 , 1173
1510 DATA 182 , 125 , 54 , 39 , 22 , 190 , 125 , 55 , 16 , 142 , 950
1520 DATA 0 , 0 , 16 , 175 , 132 , 48 , 137 , 0 , 32 , 140 , 680
1530 DATA 38 , 2 , 37 , 244 , 127 , 125 , 54 , 182 , 125 , 5 , 931
1540 DATA 74 , 129 , 0 , 38 , 1 , 57 , 189 , 125 , 5 , 183 , 801
1550 DATA 125 , 65 , 190 , 125 , 1 , 16 , 142 , 7 , 128 , 236 , 1035
1560 DATA 129 , 237 , 161 , 16 , 140 , 12 , 8 , 37 , 246 , 142 , 1128
1570 DATA 12 , 0 , 16 , 142 , 0 , 0 , 16 , 175 , 129 , 140 , 630
1580 DATA 38 , 0 , 35 , 248 , 79 , 189 , 125 , 3 , 16 , 131 , 916
1590 DATA 125 , 14 , 189 , 125 , 7 , 142 , 0 , 15 , 48 , 137 , 796
1600 DATA 28 , 127 , 189 , 122 , 136 , 16 , 142 , 0 , 0 , 142 , 902
1610 DATA 0 , 0 , 48 , 137 , 0 , 1 , 140 , 156 , 64 , 37 , 583
1620 DATA 247 , 49 , 169 , 0 , 1 , 16 , 140 , 0 , 6 , 37 , 665
1630 DATA 234 , 142 , 7 , 126 , 191 , 125 , 1 , 134 , 15 , 189 , 1160
1640 DATA 125 , 8 , 126 , 122 , 18 , 142 , 6 , 24 , 18 , 142 , 723
1650 DATA 0 , 0 , 16 , 175 , 132 , 16 , 175 , 137 , 0 , 3 , 654
1660 DATA 16 , 175 , 137 , 0 , 6 , 48 , 137 , 0 , 32 , 140 , 691
1670 DATA 7 , 129 , 37 , 234 , 126 , 125 , 78 , 254 , 0 , 0 , 989
1680 DATA 79 , 137 , 11 , 0 , 0 , 145 , 53 , 147 , 145 , 14 , 731
1690 DATA 60 , 66 , 129 , 189 , 161 , 189 , 133 , 133 , 189 , 129 , 1378
1700 DATA 66 , 60 , 64 , 112 , 124 , 126 , 127 , 126 , 124 , 112 , 1041
1710 DATA 64 , 64 , 64 , 64 , 255 , 190 , 125 , 7 , 48 , 137 , 1018
1720 DATA 28 , 127 , 134 , 50 , 189 , 125 , 55 , 134 , 255 , 189 , 1274
1730 DATA 125 , 56 , 48 , 137 , 255 , 224 , 236 , 132 , 16 , 131 , 1360
1740 DATA 0 , 0 , 39 , 11 , 134 , 1 , 189 , 125 , 54 , 191 , 738
1750 DATA 125 , 55 , 126 , 126 , 62 , 16 , 142 , 125 , 28 , 236 , 1039
1760 DATA 161 , 237 , 132 , 48 , 137 , 0 , 32 , 16 , 140 , 125 , 1028
1770 DATA 44 , 37 , 242 , 18 , 142 , 0 , 0 , 16 , 175 , 132 , 804
1780 DATA 43 , 169 , 0 , 1 , 16 , 140 , 7 , 208 , 37 , 246 , 873
1790 DATA 246 , 125 , 55 , 193 , 8 , 35 , 3 , 122 , 125 , 55 , 967
1800 DATA 122 , 125 , 56 , 134 , 63 , 189 , 255 , 35 , 246 , 125 , 1344
1810 DATA 55 , 127 , 255 , 32 , 115 , 255 , 32 , 182 , 125 , 56 , 1234
1820 DATA 74 , 38 , 253 , 90 , 38 , 244 , 134 , 55 , 183 , 255 , 1364
1830 DATA 35 , 16 , 142 , 0 , 0 , 48 , 137 , 254 , 36 , 140 , 808
1840 DATA 6 , 32 , 37 , 2 , 32 , 142 , 79 , 16 , 142 , 0 , 488
1850 DATA 0 , 49 , 169 , 0 , 1 , 16 , 140 , 156 , 64 , 37 , 632
1860 DATA 246 , 76 , 125 , 3 , 37 , 237 , 142 , 6 , 0 , 16 , 892
1870 DATA 142 , 0 , 0 , 16 , 175 , 125 , 140 , 38 , 28 , 37 , 683
1880 DATA 248 , 124 , 124 , 254 , 252 , 125 , 3 , 155 , 3 , 232 , 1560
1890 DATA 253 , 125 , 3 , 127 , 125 , 50 , 57 , 85 , 93 , 85 , 1003
```

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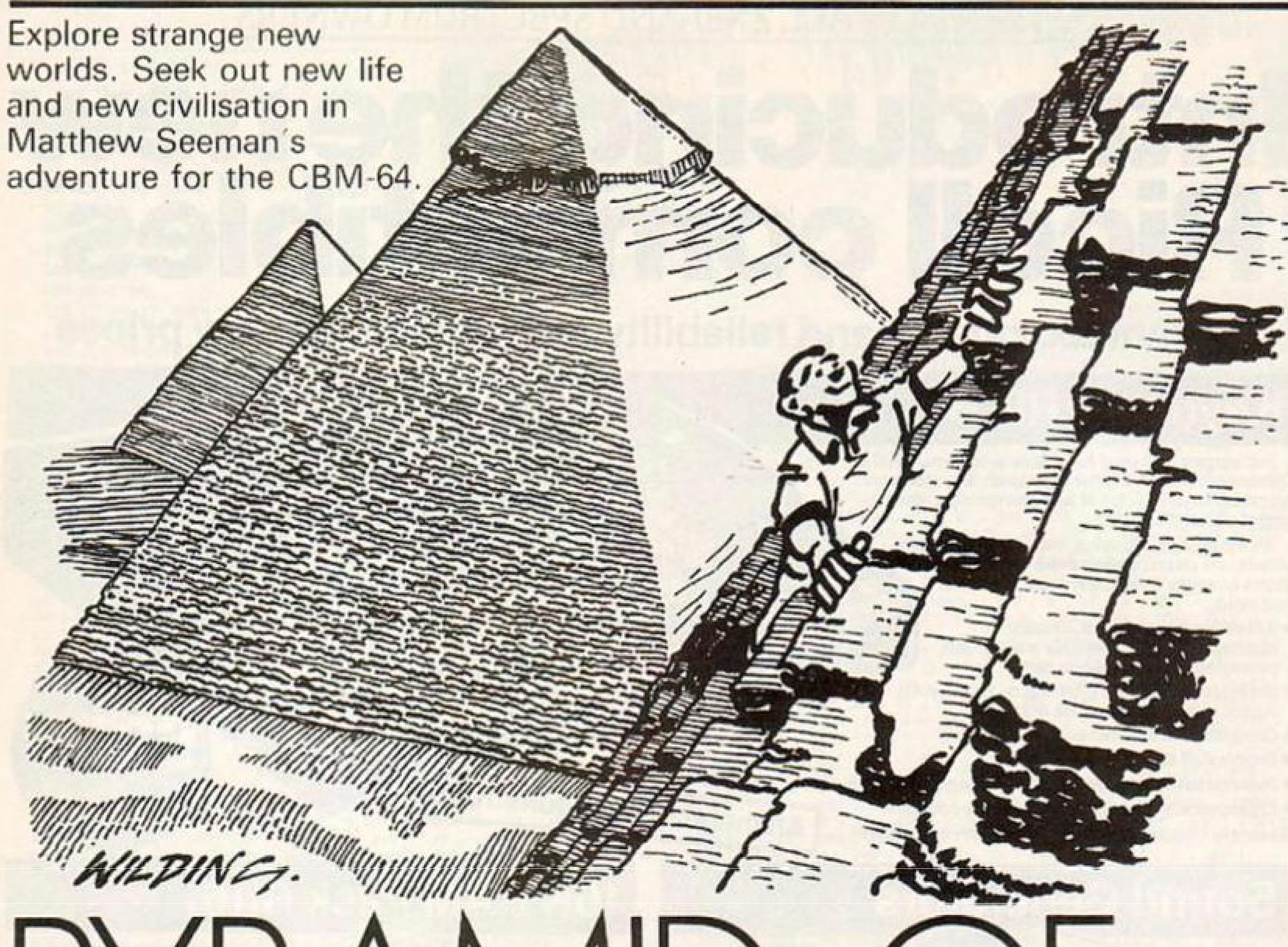
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Explore strange new worlds. Seek out new life and new civilisation in Matthew Seeman's adventure for the CBM-64.



PYRAMID OF DOOM

THIS PROGRAM is an adventure. It is called Escape from Pyramid of Doom. It is an all text adventure where you start off stuck in a pyramid and you have to collect certain objects and solve problems using the objects, your own wit and general knowledge.

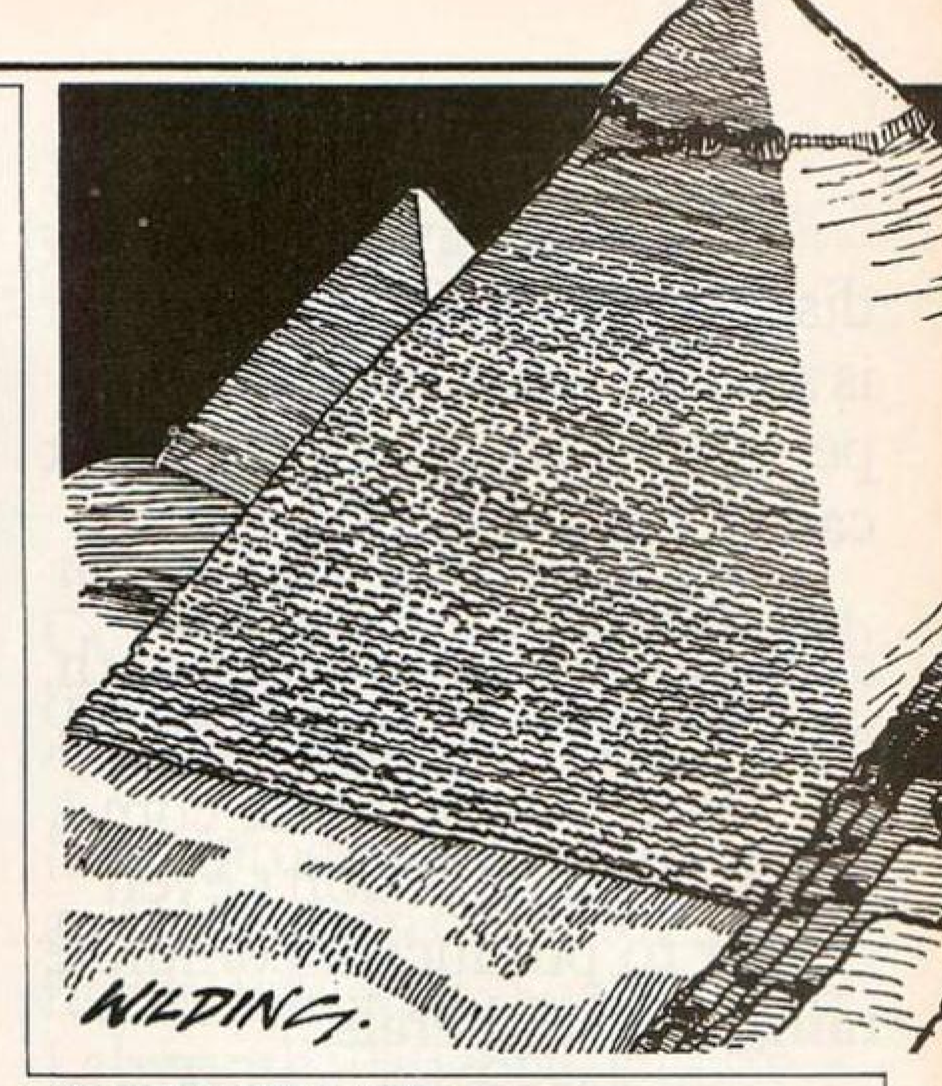
The program will run on a Commodore 64 in just under 9K. All the characters in italic print are characters which should be shifted. This is because the adventure itself runs in lower case and therefore when the program is run the shifted characters appear in upper case.

The funny graphic character in line 80 should be the inversed heart for clr/home. The game itself has various rooms and objects with plenty of problems to overcome. There is a wide vocabulary including nearly all standard adventure verbs plus some extras.

All commands should be entered in two word form ie. get key or look box. All commands should be typed with one space between the two words. If you want to save yourself some typing then only the first three letters of each word are looked at.

Escape from Pyramid of Doom should be easily convertable to other systems taking into consideration the Commodore 64's 40 by 24 column screen and also the colour and cursor controls. Any Pokes are just for screen and border colour or for zeroing the number of keys pressed and can be omitted.

```
5 CLR:RESTORE
10 DIMOB$(7,14),R$(7),X$(7),OG(5)
20 FORI=1TO7:READR$(I):NEXT
30 FORI=1TO7:READOB$(I,1):NEXT
40 FORI=1TO7:READOB$(I,2):NEXT
60 FORI=1TO7:READX$(I):NEXT
65 A=0:Y$="I SEE SOMETHING !":Y2$="I'M NOT CARRYING IT !":B=0:CO=0:PR=0
70 R=1:PRINTCHR$(14):PRINTCHR$(8):POKE53280,8:POKE53281,1:K=0:T=0:R3=0:FT=3
80 PRINT"♥":IFR=6THENPRINT"[RED]I'M BY AN EXIT.":GOTO100
90 PRINT"[RED]I'M IN A "R$(R)"."
100 PRINT:PRINT:PRINT"[PUR]THINGS I SEE.[BLU]"
110 PRINT:PRINTOB$(R,1)"    "OB$(R,2)
120 FORI=3TO12:IFOB$(R,I)<>""THENPRINTOB$(R,I):NEXT
130 IFOB$(R,I)=""THENNEXT
140 PRINT
150 PRINT"[GRN]EXITS: ";X$(R)
155 A$="":B$="":C$=""
160 PRINT:PRINT"[ORA]"M$:PRINT:PRINT"WHAT SHALL I DO NOW";:INPUTA$
170 L=LEN(A$):FORI=1TOL
180 B$=LEFT$(A$,I):B2$=RIGHT$(B$,1):IFB2$=" "THENL2=L-I:I=L+1:NEXT:GOTO200
190 NEXT
200 B$=LEFT$(B$,3):C$=RIGHT$(A$,L2):C$=LEFT$(C$,3)
210 IFB$="LOO"ORB$="SEA"ORB$="EXA"ORB$="REA"THEN400
220 IFB$="DRO"ORB$="LEA"THEN500
230 IFB$="UNL"THEN600
240 IFB$="OPE"THEN700
250 IFB$="KIL"THEN800
260 IFB$="INV"THEN900
```



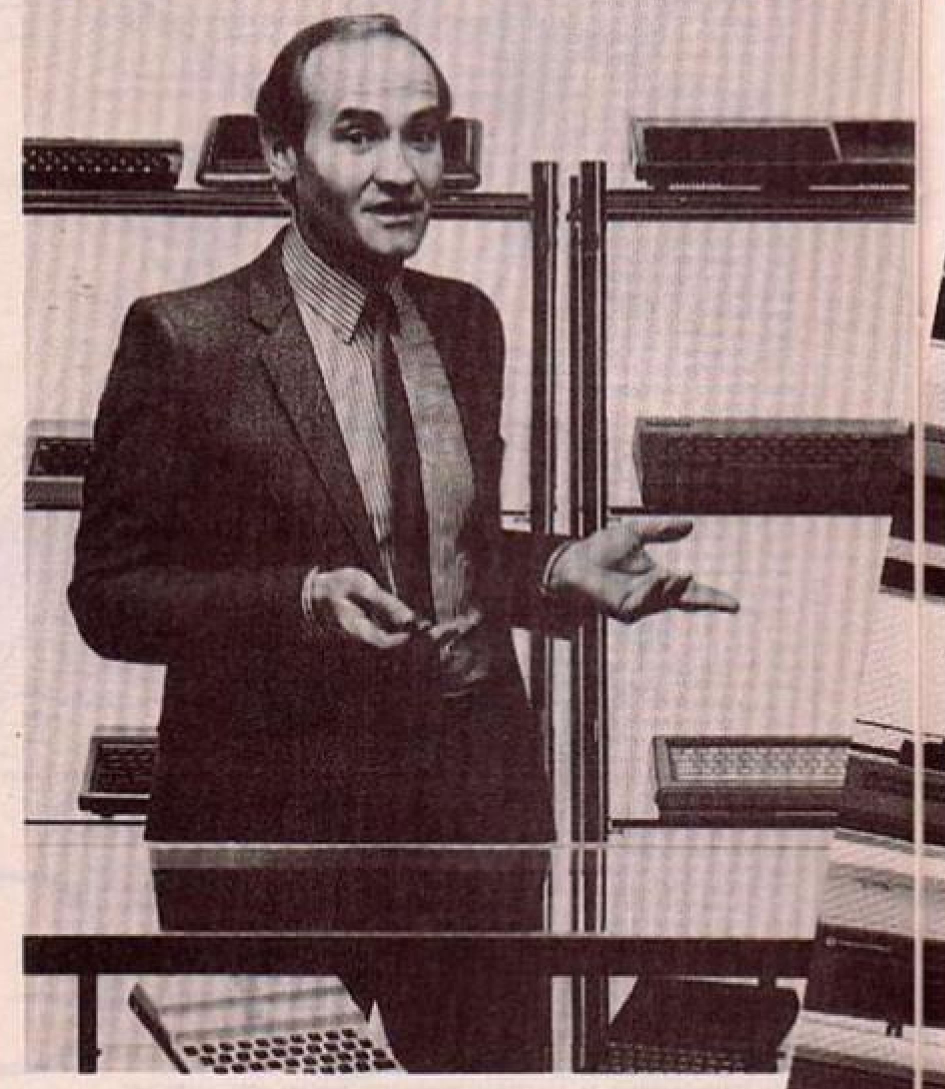

```
270 IFB$="GET"ORB$="TAK"THEN1100
280 IFB$="GO "ORB$="RUN"THEN1300
283 IFB$="HEL"THEN1560
285 IFB$="LIG"THEN1520
286 IFB$="SAY"THEN1600
287 IFB$="QUI"THEN23000
290 M$="HUH.":POKE198,0:GOTO80
400 IFC$="COF"ANDR=4ANDCO=0THENM$="ITS GOT A HEAVY LID !":GOTO80
401 IFC$="COF"ANDR=4THENF=7:GOSUB20100
402 IFC$="COF"ANDR=4ANDRE=0THENM$="ITS TOO DARK TO SEE INSIDE !":GOTO80
403 IFC$="COF"ANDR=4ANDCO=5ANDRE=1THENF$="PARCHMENT":GOSUB20000:M$=Y$:CO=7
404 IFC$="COF"ANDR=4ANDCO=7THENCO=8:GOTO80
405 IFC$="WOD"THENC$="BOX"
410 IFC$="BOX"ANDR=1ANDK=0THENM$=Y$:F$="KEY":GOSUB20000:K=1:GOTO80
415 IFC$="MIN"ANDR=6THEN21000
420 IFC$="ALT"ANDR=3ANDA=0THENM$=Y$:F$="DRAWER":GOSUB20000:A=1:GOTO80
430 IFC$="PAR"THENF=1:GOSUB20100:IFRE=0THENM$=Y2$:GOTO80
440 IFC$="PAR"ANDRE=1THEN20200
450 IFC$="DRA"ANDA=1ANDR=3THENM$=Y$:F$="METAL BAR":GOSUB20000:A=2
460 IFC$="DRA"ANDA=2ANDR=3THENM$=Y$:F$="KNIFE":GOSUB20000:A=3:GOTO80
465 F$=RIGHT$(OB$(2,1),4)
467 R3=0:IFC$="TRE"THENC$="CHE"
470 IFC$="CHE"ANDF$="OPEN"THENF$="BAG OF GOLD":GOSUB20000:R3=5
475 IFC$="CHE"ANDR3=5THENOB$(2,1)="TREASURE CHEST-EMPTY":M$=Y$:GOTO80
480 M$="I SEE NOTHING SPECIAL.":GOTO80
500 IFC$="PAR"THENF=1
510 IFC$="BAG"ORC$="GOL"THENF=2
520 IFC$="MET"ORC$="BAR"THENF=3
530 IFC$="KNI"THENF=4
540 IFC$="KEY"THENF=5
550 IFC$="TOR"THENF=6
555 IFC$="LIT"THENF=9
560 IFC$="MAT"THENF=7
570 IFC$="SIL"ORC$="SHI"THENF=8
575 GOSUB20100:IFRE=0THENM$="NOT CARRYING IT !":GOTO80
580 FORI=1TO5:IFOG(I)=FTHENOG(I)=0:M$="OK."
581 NEXT
582 IFF=1THENF$="PARCHMENT"
583 IFF=2THENF$="BAG OF GOLD"
584 IFF=3THENF$="METAL BAR"
585 IFF=4THENF$="KNIFE"
586 IFF=5THENF$="KEY"
587 IFF=6ANDTF=0THENF$="TORCH"
588 IFF=7THENF$="MATCHES"
589 IFF=8THENF$="SILVER SHIELD"
590 IFF=9THENF$="LIT TORCH"
592 GOSUB20000:IFR()6THEN80
593 F$="BAG":GOSUB20300:IFRE=0THEN80
594 F$="SIL":GOSUB20300:IFRE=0THEN80
596 M$="THE MINOTOUR GRABS THE GOLD AND THE     SHIELD AND RUNS "
597 M$=M$+"OFF LAUGHING.":OB$(6,1)="":X$(6)=X$(6)+"  NORTH"
598 F$="BAG":GOSUB20500:F$="SHI":GOSUB20500:GOTO80
600 IFC$()"TRE"ANDC$()"CHE"THEN630
605 IFC$="TRE"ORC$="CHE"ANDR=2THENF=5:GOSUB20100
610 IFRE=0ORR()2THENM$="NOT YET.":GOTO80
620 IFRE=1THENM$="OK."
621 FORI=1TO14:IFOB$(R,I)="TREASURE CHEST-LOCKED"THENOB$(R,I)="TREASURE CHEST"
622 NEXT:GOTO80
630 IFC$()"DOO"THENM$="I DONT FOLLOW YOU !":GOTO80
640 IFC$="DOO"ANDR=1THENF=5:GOSUB20100:IFRE=0THENM$="ENOT YET.":GOTO80
650 M$="OK.":OB$(1,1)="DOOR":GOTO80
700 IFC$="DOO"ANDOB$(1,1)="LOCKED DOOR"ANDR=1THENM$="NOT YET.":GOTO80
710 IFC$="DOO"ANDOB$(1,1)="DOOR"ANDR=1THENM$="OK.":OB$(1,1)="OPEN DOOR"
720 IFC$="DOO"ANDOB$(1,1)="OPEN DOOR"ANDR=1THENX$(1)=X$(1)+"  WEST":R9=1
725 IFC$="DOO"ANDR9=1ANDR=1THENF$="FIERCE WARRIOR":B=1:GOSUB20000:GOTO80
730 IFC$()"TRE"ANDC$()"CHE"ORR()2THEN770
735 TR=0
740 IFOB$(2,1)="TREASURE CHEST-LOCKED"THENM$="NOT YET.":GOTO80
750 IFOB$(2,1)="TREASURE CHEST"THENOB$(2,1)=OB$(2,1)+"-OPEN":M$="OK.":GOTO80
760 M$="ITS ALREADY OPEN !":GOTO80
770 IFC$()"COF"ORR()4THENM$="I DONT FOLLOW YOU !":GOTO80
772 F=3:GOSUB20100
774 IFRE=0THENM$="NOT YET.":GOTO80
776 IFRIGHT$(OB$(4,1),4)="OPEN"THENM$="ITS ALREADY OPEN !":GOTO80
778 IFCO=0ORCO=5THENOB$(4,1)=OB$(4,1)+"-OPEN":M$="OK.":IFCO=0THENCO=3:GOTO80
800 RE=0
805 IFC$="WAR"ANDR=1ANDB=1THENF=4:GOSUB20100:IFRE=0THENM$="NOT YET.":GOTO80
810 IFRE=1THENM$="OK.":F$="DEAD WARRIOR":B=5:I=1
815 I=I+1
820 IFRE=1ANDOB$(R,I)="FIERCE WARRIOR"THENOB$(R,I)="DEAD WARRIOR":GOTO80
830 IFI(14THEN815
835 I=0
840 IFC$="MIN"THEN21000
850 M$="EI DONT FOLLOW YOU !":GOTO80
900 FORI=1TO5:F$(I)="":NEXT
909 FORI=1TO5
910 IFOG(I)=1THENF$(I)="PARCHMENT"
920 IFOG(I)=2THENF$(I)="BAG OF GOLD"
930 IFOG(I)=3THENF$(I)="METAL BAR"
940 IFOG(I)=4THENF$(I)="KNIFE"
950 IFOG(I)=5THENF$(I)="KEY"
960 IFOG(I)=6THENF$(I)="TORCH"
970 IFOG(I)=7THENF$(I)="MATCHES"
980 IFOG(I)=8THENF$(I)="SILVER SHIELD"
985 IFOG(I)=9THENF$(I)="LIT TORCH"
990 NEXT
1000 PRINT"[ORA]I HAVE :[BLU]"
1010 PRINTF$(1)"   "F$(2)"   "F$(3)
1020 PRINTF$(4)"   "F$(5)
1030 M$="OK.":GOTO155
1100 IFC$="BOX"THENC$="WOO"
1101 IFC$="WOO"THENM$="I CANT,ITS NAILED TO THE FLOOR !":GOTO80
1102 IFC$="GOL"THENC$="BAG"
1103 IFC$="WAR"THENC$="FIE"
1104 IFC$="BAR"THENC$="MET"
1105 IFC$="CHE"THENC$="TRE"
1106 IFC$="SHI"THENC$="SIL"
1107 IFC$="DOO"THENC$=LEFT$(OB$(1,1),3)
1108 F$=C$:GOSUB20300
1110 IFRE=0THENM$="I DONT SEE IT HERE !":GOTO80
1140 F=0
1150 IFC$="PAR"THENF=1:PR=1
1160 IFC$="BAG"ORC$="GOL"THENF=2
1170 IFC$="MET"ORC$="BAR"THENF=3
1180 IFC$="KNI"THENF=4
1190 IFC$="KEY"THENF=5
1200 IFC$="TOR"THENF=6
1210 IFC$="MAT"THENF=7
1220 IFC$="SIL"ORC$="SHI"THENF=8
1223 IFC$="LIT"THENF=9
1225 IFF=0THENM$="I CANT DO THAT !":GOTO80
1230 GOSUB20400:IFRE=0THENM$="IM CARRYING TOO MUCH !":GOTO80
1240 F$=C$:GOSUB20500:IFRE=0THENM$="I DONT FOLLOW YOU !":GOTO80
1250 M$="OK.":GOTO80
1300 Y4$="I CANT GO THAT WAY !":M$=""
1301 ONRGOTO1310,1370,1410,1430,1450,1460,1500
1310 IFC$="EAS"THENM$="OK.":R=2:GOTO80
1320 IFC$="NOR"THENM$="OK.":R=7:GOTO80
1330 IFRIGHT$(X$(1),4)="WEST"ANDC$="WES"ANDB()5THENM$="WARRIOR WONT LET ME !"
1340 IFM$="WARRIOR WONT LET ME !"THEN80
1350 IFRIGHT$(X$(1),4)="WEST"ANDC$="WES"ANDB=5THENM$="OK.":R=5:B=5:GOTO80
1355 IFC$="DOO"THENM$="SORRY.":GOTO80
1360 M$=Y4$:GOTO80
1370 IFC$="EAS"THENR=3:M$="OK.":GOTO80
1380 IFC$="WES"THENR=1:M$="OK.":GOTO80
1390 IFC$="SOU"THENR=4:M$="OK.":GOTO80
1400 M$=Y4$:GOTO80
1410 IFC$="WES"THENR=2:M$="OK.":GOTO80
1420 M$=Y4$:GOTO80
1430 IFC$="NOR"THENR=2:M$="OK.":GOTO80
1440 M$=Y4$:GOTO80
1450 IFC$="EAS"THENR=1:GOTO80
1460 IFC$="NOR"THENR=6:GOTO80
1470 M$=Y4$:GOTO80
1480 IFC$="SOU"THENR=5:M$="OK.":GOTO80
1483 IFC$="EXI"ANDOB$(6,1)="MINOTAUR"THEN21000
1485 IFC$="EXI"THENM$="SORRY.":GOTO80
1486 IFC$="NOR"ANDOB$(6,1)=""THEN22000
1490 M$=Y4$:GOTO80
1500 IFC$="SOU"THENR=1:M$="OK.":GOTO80
1510 IFC$="NOR"ORC$="SOU"ORC$="EAS"THENM$="OK.":R=7:GOTO80
1515 M$="I DONT FOLLOW YOU !":GOTO80
1520 IFC$()"TOR"THENM$="I DONT FOLLOW YOU !":GOTO80
1530 F=6:GOSUB20100:IFRE=0THENM$="NOT CARRYING IT !":GOTO80
1540 M$="OK TORCH LIT.":CO=5:FT=3
1550 FORI=1TO5:IFOG(I)=6THENOG(I)=9
1555 NEXT:GOTO80
1560 F=1:GOSUB20100:IFRE=0THENM$="EXAMINE THINGS,EXPERIMENT.":GOTO80
1570 IFPR=0THENM$="READ THE PARCHMENT ?":GOTO80
1580 IFPR=1THENM$="THE MAGIC WORD MIGHT GET YOU SOMEWHERE.":GOTO80
1590 M$="EXAMINE THINGS,EXPERIMENT.":GOTO80
1600 IFC$()"SIL"THENM$="OK...NOTHING HAPPENS.":GOTO80
1605 IFPR()1THENM$="OK.SILVER SHIELD...NOTHING HAPPENS":GOTO80
1610 IFPR=1THENM$="A SHIELD MATERIALISES !":F$="SILVER SHIELD":GOSUB20000
1620 IFR()6THENPR=5:GOTO80
1630 F$="BAG":GOSUB20300:IFRE=0THEN80
1640 PRINT"[DWN]"M$:PRINT"[2DWN]THE MINOTOUR GRABS THE GOLD AND THE ":M$="OK."
1650 PRINT"SHILED AND RUNS OFF LAUGHING.":OB$(6,1)="":X$(6)=X$(6)+"  NORTH"
1660 F$="BAG":GOSUB20500:F$="SIL":GOSUB20500:GOTO155
20000 FORI=1TO14
20005 IFOB$(R,I)=F$THENI=15:NEXT:RETURN
20010 IFOB$(R,I)=""THENOB$(R,I)=F$:I=15:NEXT:RETURN
20020 NEXT:RETURN
20100 FORI=1TO5:IFOG(I)=FTHENRE=1:I=6:NEXT:RETURN
20110 NEXT:RE=0:RETURN
20200 PRINT"[ORA]PARCHMENT SAYS :"
20210 PRINT"MAGIC WORD IS '[BLU]SILVER SHIELD[ORA]'."
20220 PRINT"[DWN][ORA]ADVICE: STAY CLEAR OF THE MINOTOUR.":GOTO155
20300 FORI=1TO14
20310 IFLEFT$(OB$(R,I),3)=F$THENRE=1:I=15:NEXT:RETURN
20320 NEXT:RE=0:RETURN
20400 FORI=1TO5:IFOG(I)=0THENOG(I)=F:I=6:NEXT:RE=1:RETURN
20410 NEXT:RE=0:RETURN
20500 FORI=1TO14:IFLEFT$(OB$(R,I),3)=F$THENOB$(R,I)="":I=15:NEXT:RE=1:RETURN
20510 NEXT:RE=0:RETURN
21000 PRINT"[BLU]THE MINOTAUR DIDN'T LIKE THAT IDEA."
21010 PRINT"[DWN]IT TURNED NASTY ON ME.IM DEAD."
21020 INPUT"[2DWN]ANOTHER GO (Y/N) ";F$
21030 IFLEFT$(F$,1)="Y"THENRUN
21040 IFLEFT$(F$,1)()"N"THEN21020
21050 PRINT"[DWN][LI-BLU]THANKS FOR PLAYING.":END
22000 PRINT"[BLU]YOU'VE DONE IT !"
22010 PRINT"[DWN]YOU'VE HELPED ME ESCAPE !"
22020 PRINT"[DWN]THANK YOU."
22030 INPUT"[2DWN][LI-BLU]ANOTHER GO (Y/N) ";F$
22040 IFLEFT$(F$,1)="Y"THENRUN
22050 IFLEFT$(F$,1)()"N"THEN22030
22060 PRINT"[DWN][BLU]THANKS FOR PLAYING.":END
23000 PRINT"[BLU][DWN]MANY TRY,BUT FEW SUCCEED !!":GOTO22030
30000 DATACORRIDOR,HOLD,CHAPEL,TOMB,NARROW TUNNEL,EXIT,MAZE
30010 DATALOCKED DOOR,TREASURE CHEST-LOCKED,ALTER,LARGE STONE COFFIN,,MINOTAUR,
30020 DATAWOODEN BOX,,,,TORCH,,
30030 DATANORTH  EAST,EAST  WEST  SOUTH,WEST,NORTH,NORTH  EAST,SOUTH
30040 DATANORTH  WEST  EAST  SOUTH
```

As you may have already discovered, buying a computer is simple, but buying the peripherals for a computer, that can be a real headache.

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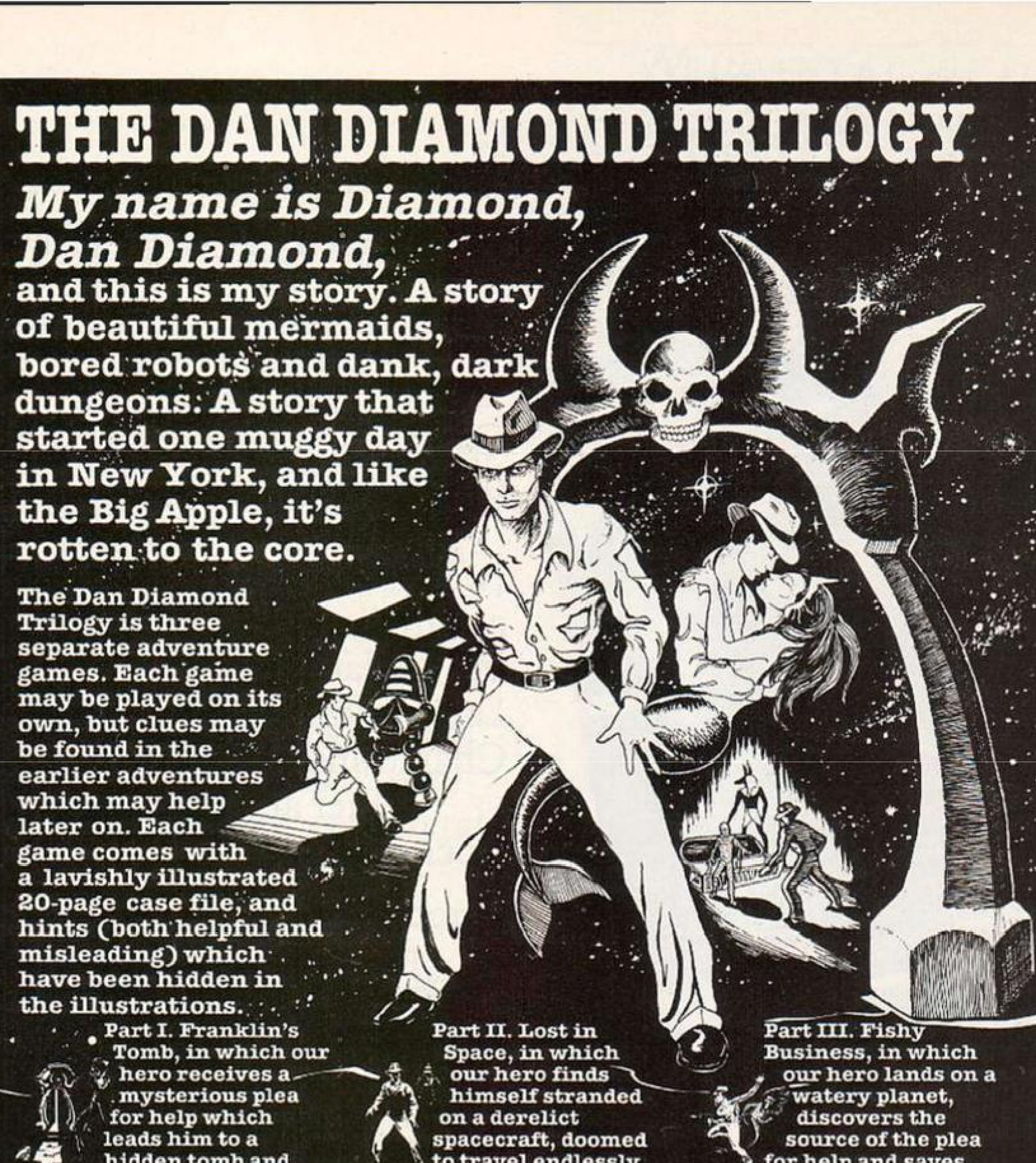
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THE DAN DIAMOND TRILOGY
My name is Diamond, Dan Diamond,
and this is my story. A story of beautiful mermaids, bored robots and dank, dark dungeons. A story that started one muggy day in New York, and like the Big Apple, it's rotten to the core.
The Dan Diamond Trilogy is three separate adventure games. Each game may be played on its own, but clues may be found in the earlier adventures which may help later on. Each game comes with a lavishly illustrated 20-page case file, and hints (both helpful and misleading) which have been hidden in the illustrations.
Part I. Franklin's Tomb, in which our hero receives a mysterious plea for help which leads him to a hidden tomb and the mystery of the stargate.
Part II. Lost in Space, in which our hero finds himself stranded on a derelict spacecraft, doomed to travel endlessly through space, or find a way out.
Part III. Fishy Business, in which our hero lands on a watery planet, discovers the source of the plea for help and saves the day.



Chris Carr gets his own back with a BBC micro.

ONE BIG ADVANTAGE of the BBC Micro is its ability to translate 6502 mnemonics straight into machine code with its built in assembler. The program listed here, which will run on any 32K BBC Micro uses the assembler to create a fast-action machine code arcade game. On execution, a title page is displayed, which explains the controls and prompts any key to start.

A special screen handling routine is used to generate the multi-coloured graphics characters which swoop down and attack your laser base, dropping bombs as they go. You must use all your skill and a rapid-firing laser to blast the aliens out of the sky. The program also features envelope-defined sound effects, on screen scoring and mutant aliens for extra points.

Each alien hit scores 10 points with a bonus of 50 points when a screen is cleared, after

(continued on next page)

```
   10REM*** AVENGER ***
   20REM*** BY CHRIS CARR 1
983 ***
   30REM*** READ DATA ***
   40DIM BASE 4096
   50FORJ%=BASE TO BASE+397
   60READD%:?J%=D%:NEXT
   70CHARS=BASE:R=BASE+80:N
UMBERS=BASE+208:LTRS=BASE+2
88:DFENV=BASE+384
   80VCHAR=BASE+408:X=BASE+
420
   90Y=BASE+432:XMOT=BASE+4
44
  100YMOT=BASE+456:VBOMB=BA
SE+468
  110XBOMB=BASE+474:YBOMB=B
ASE+480
  120VMISSILE=BASE+486
  130XMISSILE=BASE+492:YMIS
SILE=BASE+498
  140SND=BASE+504
  150SCREEN=BASE+512
  160CODE=BASE+1100
  170FORJ%=VCHAR TO CODE:?J
%=0:NEXT
  180?SND=0:?(SND+2)=1:?(SN
D+3)=0:?(SND+6)=1:?(SND+4)=
3
  190PROCSCR
  200REM*** CODE ***
  210FOR PASS=0TO2 STEP2
  220P%=CODE
  230[
  240OPTPASS
  250.START
  260JSR DENV
  270JSR TITLES
  280JSR ZPAGE
  290JSR RESET
  300JSR TLINE
  310.MLOOP2
  320JSR SETUP
  330\MAIN LOOP
  340.MLOOP
  350JSR RINC
  360LDA &71
  370BEQ LABEL2
  380LDA #00
  390STA &71
  400JMP LABEL3
  410.LABEL2
  420LDA #01
  430STA &71
  440.LABEL3
  450LDX #06
  460CMP #00
  470BNE LABEL4
  480LDX #12 \CHANGE BACK !
  490.LABEL4
  500LDY #06
  510.LOOP6
  520DEY
  530BPL CONT
  540JMP PBOMBS
  550.CONT
  560DEX
  570LDA VCHAR,X
  580BEQ LOOP6
  590LDA X,X
  600STA &72
  610LDA Y,X
  620STA &73
  630STY &76
  640STX &77
  650JSR ERASE
  660LDX &77
  670LDY &70
  680LDA R,Y
  690CMP #50
  700BCS LABEL5
  710JSR RINC
  720LDY &70
  730LDA R,Y
  740CMP #64
  750BCC LABEL6
  760LDA #01
  770JMP LABEL7
  780.LABEL6
  790LDA #255
  800.LABEL7
  810STA XMOT,X
  820.LABEL5
  830LDY &76
  840\WORK OUT NEW LOCATION
  850CLC
  860LDA X,X
  870ADC XMOT,X
  880STA &72
  890CLC
  900LDA Y,X
  910ADC YMOT,X
  920STA &73
  930\ON EDGES ?
  940LDA &72
  950CMP #01
  960BCS LABEL8
  970LDA #01
  980STA XMOT,X
  990.LABEL8
 1000LDA &72
 1010CMP #39
 1020BCC LABEL9
 1030LDA #255
 1040STA XMOT,X
 1050.LABEL9
 1060\ON TOP OR BOTTOM
 1070LDA &73
 1080\CMP #01
 1090BNE LABEL0
 1100LDA #01
 1110STA YMOT,X
 1120.LABEL0
 1130LDA &73
 1140CMP #31
 1150BNE LABELA
 1160LDA #255
 1170STA YMOT,X
 1180.LABELA
 1190CLC
 1200LDA X,X
 1210ADC XMOT,X
 1220STA &72
 1230CLC
 1240LDA Y,X
 1250ADC YMOT,X
 1260STA &73
 1270\STORE FINAL VALUE
 1280LDA &72
 1290STA X,X
 1300LDA &73
 1310STA Y,X
 1320STY &76
 1330STX &77
 1340LDA #15
 1350STA &78
 1360JSR SPRINT
 1370\** BOMBS **
 1380.BOMBS
 1390\REGISTER AVAILABLE
 1400LDX #05
 1410.LOOPC
 1420LDA VBOMB,X
 1430BEQ LABELB
 1440DEX
 1450BPL LOOPC
 1460LDX &77
 1470LDY &76
 1480JMP LOOP6
 1490.LABELB
 1500TXA
 1510TAY
 1520LDX &77
 1530LDA X,X
 1540STA XBOMB,Y
 1550LDA Y,X
 1560CLC
 1570ADC #01
 1580STA YBOMB,Y
 1590LDA #01
 1600STA VBOMB,Y
 1610LDY &76
 1620JMP LOOP6
 1630\PRINT BOMBS
 1640.PBOMBS
 1650LDX #06
 1660.LOOPD
 1670DEX
 1680BPL CONT1
 1690JMP SHIP
 1700.CONT1
 1710LDA VBOMB,X
 1720BEQ LOOPD
 1730LDA XBOMB,X
 1740STA &72
 1750LDA YBOMB,X
 1760STA &73
 1770STX &77
 1780JSR ERASE
 1790LDX &77
 1800LDA YBOMB,X
 1810CMP #31
 1820BNE CONT3
 1830LDA #00
 1840STA VBOMB,X
 1850JMP CHECK3
 1860.CONT3
 1870LDA YBOMB,X
 1880CLC
 1890ADC #01
 1900STA YBOMB,X
 1910STA &73
 1920LDA XBOMB,X
 1930STA &72
 1940STX &77
 1950LDA #47
 1960STA &78
 1970JSR SPRINT
 1980LDX &77
 1990\CHECK FOR BOMB
 2000\HITTING MISSILE
 2010LDY #07
 2020.LOOPI
 2030DEY
 2040BPL CONT9
 2050JMP CHECK3
 2060.CONT9
 2070LDA VMISSILE,Y
 2080BEQ LOOPI
 2090LDA XBOMB,X
 2100CMP XMISSILE,Y
 2110BNE LOOPI
 2120LDA YBOMB,X
 2130CMP YMISSILE,Y
 2140BNE LOOPI
 2150LDA #00
 2160STA VMISSILE,Y
 2170STA VBOMB,X
 2180LDA XBOMB,X
 2190STA &72
 2200LDA YBOMB,X
 2210STA &73
 2220STX &77
 2230JSR ERASE
 2240LDX &77
 2250\CHECK FOR BOMB
 2260.CHECK3
 2270\HITTING BASE
 2280LDA YBOMB,X
 2290CMP #31
 2300BEQ CONTA
 2310JMP LOOPD
 2320.CONTA
 2330LDA XBOMB,X
 2340CMP &79
 2350BEQ CONTB
 2360JMP LOOPD
 2370.CONTB
 2380\BASE HIT
 2390LDA &79
 2400STA &72
 2410LDA #31
 2420STA &73
 2430LDA #79
 2440STA &78
 2450STX &77
 2460JSR SPRINT
 2470LDA #03
 2480STA SND+4
 2490.LOOPK
 2500LDX &84
 2510LDY &85
 2520LDA #07
 2530JSR &FFF1
 2540LDA SND+4
 2550CLC
 2560ADC #24
 2570STA SND+4
 2580CMP #11
 2590BNE LOOPK
 2600LDA #01
 2610STA SND+6
 2620LDA #00
 2630STA &79
 2640DEC &87
 2650BEQ LABELG
 2660JSR WAIT2
 2670JSR WAIT2
 2680JSR WAIT2
 2690JSR ERASE
 2700LDA #15
 2710LDX #00
 2720JSR &FFF4
 2730LDX &77
 2740JMP LOOPB
 2750.LABELG
 2760JSR WAIT2
 2770JSR WAIT2
 2780JSR WAIT2
 2790JSR WAIT2
 2800LDA #15
 2810LDX #00
 2820JSR &FFF4
 2830JMP START
 2840\SHIP
 2850.SHIP
 2860\ERASE SHIP
 2870LDA &79
 2880STA &72
 2890LDA #31
 2900STA &73
 2910JSR ERASE
 2920\INPUT FROM KEYBOARD
 2930LDA #129
 2940LDX #&9E
 2950LDY #&9E
 2960JSR &FFF4
 2970CPY #00
 2980BEQ RIGHT
 2990LDA &79
 3000CLC
 3010ADC #255
 3020BMI CONT4
 3030STA &79
 3040JMP CONT4
 3050.RIGHT
 3060LDA #129
 3070LDX #&BD
 3080LDY #&BD
 3090JSR &FFF4
 3100CPY #00
 3110BEQ CONT4
 3120LDA &79
```

(listing continued on next page)

(continued from previous page)

which the stock of aliens is replenished and the speed of the game increases.

The program should be typed in exactly as it appears except for the title page — lines 8090 to 8120. As the incorrect number of spaces could be disastrous, asterisks have been substituted in the listing. The title page also uses teletext control characters. These should be printed in direct mode onto the screen — not in Mode 7 — then copied into the program, or they can be left out.

In the listing of the title page 1 represents the non-printing ASCII code equivalent to CHR$ 129; 2 represents CHR$ 141; 3 represents CHR$ 131; 4 represents CHR$ 133.

When the program has been completely typed in it should be Saved before running in case of any typing errors, which could crash the program. On running, two identical hex numbers are printed. This is the execution address of the machine code and is equal to the variable Start.

If you wish to Save just the machine code and not all the mnemonics, then the manual explains how in the section on file handling.

(listing continued from previous page)

```
3130CLC
3140ADC #01
3150CMP #39
3160BEQ CONT4
3170STA &79
3180.CONT4
3190\PRINT BASE
3200LDA &79
3210STA &72
3220LDA #31
3230STA &73
3240LDA #31
3250STA &78
3260JSR SPRINT
3270.MISSILES
3280\CHECK FOR MISSILE KEY
3290LDA #129
3300LDX #255
3310LDY #&FF
3320JSR &FFF4
3330CPY #00
3340BEQ EXERASE
3350\REGISTER AVAILABLE
3360LDX #05
3370.LOOPE
3380LDA VMISSILE,X
3390BEQ LABELE
3400DEX
3410BPL LOOPE
3420JMP EXERASE
3430.LABELE
3440LDA &79
3450STA XMISSILE,X
3460LDA #30
3470STA YMISSILE,X
3480LDA #01
3490STA VMISSILE,X
3500\PRINT OUT EXPLOSION
3510.EXERASE
3520LDA &83
3530BEQ PMISSILES
3540LDA &81
3550STA &72
3560LDA &82
3570STA &73
3580JSR ERASE
3590LDA #00
3600STA &83
3610.PMISSILES
3620LDX #06
3630.LOOPF
3640DEX
3650BPL CONT5
3660JMP ALLDONE
3670.CONT5
3680LDA VMISSILE,X
3690BEQ LOOPF
3700LDA XMISSILE,X
3710STA &72
3720LDA YMISSILE,X
3730STA &73
3740STX &77
3750JSR ERASE
3760LDX &77
3770LDA YMISSILE,X
3780BNE CONT6
3790LDA #00
3800STA VMISSILE,X
3810JMP LOOPF
3820.CONT6
3830LDA YMISSILE,X
3840CLC
3850ADC #255
3860STA YMISSILE,X
3870STA &73
3880LDA XMISSILE,X
3890STA &72
3900STX &77
3910LDA #A3
3920STA &78
3930JSR SPRINT
3940LDX &77
3950\CHECK FOR MISSILE
3960\HITTING AVENGER
3970LDY #13
3980.LOOPG
3990DEY
4000BMI CHECK2
4010LDA VCHAR,Y
4020BEQ LOOPG
4030LDA XMISSILE,X
4040CMP X,Y
4050BNE LOOPG
4060LDA YMISSILE,X
4070CMP Y,Y
4080BNE LOOPG
4090STY &76
4100STX &77
4110LDA #180
4120STA &86
4130JSR MSOUND
4140LDX &77
4150LDY &76
4160LDA #00
4170STA VCHAR,Y
4180STA VMISSILE,X
4190LDA XMISSILE,X
4200STA &72
4210STA &81
4220LDA YMISSILE,X
4230STA &73
4240STA &82
4250STX &77
4260LDA #79
4270STA &78
4280JSR SPRINT
4290LDA #01
4300STA &83
4310LDX &77
4320JSR SCORE
4330\CHECK FOR MISSILE
4340\HITTING BOMB
4350.CHECK2
4360LDY #7
4370.LOOPH
4380DEY
4390BPL CONT8
4400JMP LOOPF
4410.CONT8
4420LDA VBOMB,Y
4430BEQ LOOPH
4440LDA XMISSILE,X
4450CMP XBOMB,Y
4460BNE LOOPH
4470LDA YMISSILE,X
4480CMP YBOMB,Y
4490BNE LOOPH
4500LDA #00
4510STA VBOMB,Y
4520STA VMISSILE,X
4530LDA XMISSILE,X
4540STA &72
4550LDA YMISSILE,X
4560STA &73
4570STX &77
4580JSR ERASE
4590LDX &77
4600JMP LOOPF
4610.ALLDONE
4620JMP CHECKAVD
4630.ENDCHECK
4640JSR WAIT
4650JMP MLOOP
4660JMP FINISH
4670\** SUB ROUTINES **
4680\** SET VARIABLES **
4690.SETUP
4700LDX #05
4710LDY #10
4720.LOOP
4730TYA:STA X,X
4740DEY:DEY:DEX
4750BPL LOOP
4760\2ND RANK X
4770LDX #05
4780LDY #31
4790.LOOP1
4800TYA:STA X+6,X
4810DEY:DEY:DEX
4820BPL LOOP1
4830\Y
4840LDY #05
4850LDX #08
4860.LOOP2 TXA:STA Y,Y
4870DEX:DEY:BPL LOOP2
4880LDY #05
4890LDX #03
4900.LOOP3 TXA:STA Y+6,Y
4910INX:DEY:BPL LOOP3
4920\X & Y MOTION
4930LDX #23
4940.LOOP4
4950LDY &70
4960LDA R,Y
4970CMP #64
4980BCS GREATER
4990LDA #255
5000JMP LABEL
5010.GREATER
5020LDA #01
5030.LABEL
5040STA XMOT,X
5050JSR RINC
5060DEX
5070BPL LOOP4
5080\SET TO ZERO
5090LDA #01
5100LDX #11
5110.LOOP5
5120STA VCHAR,X
5130DEX
5140BPL LOOP5
5150RTS
5160\** INC **
5170.RINC
5180INC &70
5190LDA #129
5200CMP &70
5210BNE LABEL1
5220LDA #00
5230STA &70
5240.LABEL1
5250RTS
5260\** ERASE **
5270.ERASE
5280\CALC POSITION
5290LDX #03
5300LDA &72
5310STA &74
5320LDA #00
5330STA &75
5340.LOOP7
5350CLC
5360ASL &74
5370ROL &75
5380DEX
5390BNE LOOP7
5400LDX &73
5410.LOOP8
5420CLC
5430LDA &74
5440ADC #64
5450STA &74
5460LDA &75
5470ADC #01
5480STA &75
5490DEX
5500BNE LOOP8
5510\ADD HIMEM
5520CLC
5530LDA &75
5540ADC #88
5550STA &75
5560LDY #15
5570LDA #0
5580.LOOP9
5590STA (&74),Y
5600DEY
5610BPL LOOP9
5620RTS
5630\** PRINT **
5640.SPRINT
5650\CALC POSITION
5660LDX #03
5670LDA &72
5680STA&74
5690LDA #00
5700STA &75
5710.LOOP0
5720CLC
5730ASL &74
5740ROL &75
5750DEX
5760BNE LOOP0
5770LDX &73
5780.LOOPA
5790CLC
5800LDA &74
5810ADC #64
5820STA &74
5830LDA &75
5840ADC #01
5850STA &75
5860DEX
5870BNE LOOPA
5880\ADD HIMEM
5890CLC
5900LDA &75
5910ADC #88
5920STA &75
5930LDY #15
5940LDX &78
5950.LOOPB
5960LDA CHARS,X
5970STA (&74),Y
5980DEX
5990DEY
6000BPL LOOPB
6010RTS
6020\WAIT
6030.WAIT
6040LDY &7B
6050.LOOPW
6060LDX #255
6070.LOOPW1
6080DEX
6090BNE LOOPW1
6100DEY
6110BNE LOOPW
6120RTS
6130\MAKE SOUND
6140.MSOUND
6150LDA &86
6160STA SND+4
6170LDA #07
6180LDX &84
6190LDY &85
6200JSR &FFF1
6210RTS
6220\WAIT2
6230.WAIT2
6240LDY #255
6250.LOOPWW
6260LDX #255
6270.LOOPWW1
6280NOP
6290NOP
6300NOP
6310NOP
6320DEX
6330BNE LOOPWW1
6340DEY
6350BNE LOOPWW
6360RTS
6370\SCORE INCREMENT
6380\AND PRINT
6390.SCORE
6400INC &8A
6410LDA #10
6420CMP &8A
6430BNE PSCORE
6440LDA #00
6450STA &8A
6460INC &89
6470LDA #10
6480CMP &89
6490BNE PSCORE
6500LDA #00
6510STA &89
6520INC &88
6530.PSCORE
6540LDX #03
6550LDY #23
6560.LOOPL
6570DEX
6580STX &8D
6590LDA 136,X
6600ASL A
6610ASL A
6620ASL A
6630CLC
6640ADC #07
6650TAX
6660LDA #07
6670STA &8E
6680.LOOPM
6690LDA NUMBERS,X
6700STA 22528+64,Y
6710DEX
6720DEY
6730DEC &8E
6740BPL LOOPM
6750LDX &8D
6760BNE LOOPL
6770RTS
6780\*** TITLES ***
6790.TITLES
6800LDA #240
6810STA &88
6820LDA #124
6830STA &89
6840LDA #(SCREEN MOD 256)
6850STA &8A
6860LDA #(SCREEN DIV 256)
6870STA &8B
6880LDA #22
6890JSR &FFEE
6900LDA #07
6910JSR &FFEE
6920LDA #124
6930STA &7
6940LDX #07
6950LDY #00
6960.LP1
6970LDA (&8A),Y
6980STA (&88),Y
6990INY
7000BNE LP1
7010INC &89
7020INC &8B
7030DEX
7040BNE LP1
7050JSR &FFE6
7060LDA #22
7070JSR &FFEE
7080LDA #05
7090JSR &FFEE
7100LDA #88
7110STA &7
7120RTS
7130\CHECK FOR ALL
7140\DESTROYED
7150.CHECKAVD
7160LDX #11
7170.LOOPQ
7180LDA VCHAR,X
7190BNE CONTE
7200DEX
7210BPL LOOPQ
7220\NEW
7230\SCREEN
7240LDA #00
7250STA &86
7260LDA #01
7270STA SND
7280.LOOPR
7290JSR MSOUND
7300INC &86
7310INC &86
7320INC &86
7330INC &86
7340BNE LOOPR
7350LDA #00
7360STA SND
7370LDA &7B
7380SEC
7390SBC #05
7400STA &7B
7410LDA #00
7420STA &79
7430LDA #12
7440JSR &FFEE
7450LDA #15
7460LDX #00
7470JSR &FFF4
7480JSR TLINE
7490JSR SCORE
7500JSR SCORE
7510JSR SCORE
7520JSR SCORE
7530JSR SCORE
7540JMP MLOOP2
7550.CONTE
7560JMP ENDCHECK
7570\ZERO PAGE
7580.ZPAGE
7590LDA #00
7600STA &70
7610STA &88
7620STA &89
7630STA &8A
7640STA &79
7650LDA #03
7660STA &87
7670LDA #50
7680STA &7B
7690LDA #(SND MOD256)
7700STA &84
7710LDA #(SND DIV256)
7720STA &85
7730RTS
7740\SET TOP LINE
7750\OF DISPLAY
7760.TLINE
7770LDX #95
7780.LP4
7790LDA LTRS,X
7800STA 22528,X
7810DEX
7820BPL LP4
7830RTS
7840\RESET BOMBS
7850\AND MISSILES
7860.RESET
7870LDX #05
7880LDA #00
7890.LP5
7900STA VBOMB,X
7910STA VMISSILE,X
7920DEX
7930BPL LP5
7940RTS
7950\DEFINE ENVELOPE
7960.DENV
7970LDY #(DFENV DIV256)
7980LDX #(DFENV MOD256)
7990LDA #08
8000JSR &FFF1
8010RTS
8020\** FINISH **
8030.FINISH
8040RTS:]
8050NEXTPASS
8060END
8070REM*** DATA FOR TITLES

8080DEFPROCSCR
8090$SCREEN="*************
*12AVENGER*****************
***************12AVENGER****
****************************
****************************
************3By*Chris*Carr**
*************"
8100$(SCREEN+160)="*******
****************************
****************************
****************************
******42...Left*************
****************************
******************"
8110$(SCREEN+320)="*******
********4X...Right**********
****************************
****************************
***4L*SHIFT*to*Fire*********
*****"
8120$(SCREEN+440)="*******
****************************
*******************Any*Key*to
*Start************"

8130ENDPROC
8140REM*** DATA ***
8150REM*** CHARS (80) ***
8160DATA0,192,209,231,231,
209,192,0,0,48,184,126,126,
184,48,0,0,17,17,17,209,227
,199,143,0,136,136,136,184,
124,62,31

8170DATA0,3,1,3,1,3,1,0,0,
0,8,0,8,0,8,0,0,0,16,33,33,
16,0,0,0,0,128,72,72,128,0,
0,8,4,2,112,16,18,20,8,1,13
0,132,128,224,4,2,1
8180REM*** (128) ***

8190DATA83,65,96,7,110,40,
125,51,114,72,16,2,120,82,1
28,98,108,70,99,77,11,22,12
1,13,53,58,17,31,122,88,3,6
7,64,111,42,73,50,123,56,28
,127,101,113,19,91,27,115,7
4,80,97,78,5,79,45,100,126,
47,94,24,21,81,33,7

8200DATA48,20,75,55,102,41
,4,34,49,29,37,105,104,8,10
7,60,46,89,39,92,59,84,35,2
3,57,52,69,30,61,18,95,90,6
6,116,36,87,109,32,76,112,8
6,93,44,117,25,38,12,103,6,
14,26,71,62,85,119,63,15,54
,10,68,124,43,118,129,106
8210REM*** NUMBERS (80)

8220DATA119,85,85,85,85,85
,119,0,17,17,17,17,17,17,17
,0,119,17,17,34,68,68,119,0
,119,17,17,51,17,17,119,0,6
8,68,68,119,34,34,0,119,
68,68,119,17,17,119,0,119,6
8,68,119,85,85,119,0
8230DATA119,17,17,17,17,17
,17,0,119,85,85,119,85,85,1
19,0,119,85,85,119,17,17,17
,0
8240REM*** LETTERS (64)

8250DATA119,68,68,119,17,1
7,119,0,119,68,68,68,68,68,
119,0,119,85,85,85,85,85,11
9,0,119,85,85,119,102,85,85
,0,119,68,68,102,68,68,119,
0,0,0,0,0,0,0,0,0,0,0,119,0
,119,0,0,0,0,0,0,0,0,0,0,0
8260DATA119,85,85,85,85,85
,119,0,119,85,85,85,85,85,1
19,0,119,85,85,85,85,85,119
,0,119,85,85,85,85,85,119,0
,1,3,1,-1,1,1,1,1,121,-23,-
12,-6,120,120
```

LETTER DROP is a word game which runs on a Vic-20 with 8K or more expansion. It is a multilevel game which can be played by primary school children to improve their spelling and vocabulary, and by adults who are word fanatics, Scrabble players or crossword fanatics. The level of play is up to you.

It requires rapid thinking, but not nimble fingers. The action is in your head. The idea is simple — the computer takes a word jumbles up the letters, and then slowly reconstructs the word as it randomly moves the letters round a specified area of the screen. Your task is to get to the word before the computer gets too far. Not too bad . . . until you realise that the letters of lips for example also spells slip and lisp. With longer words the problems increase.

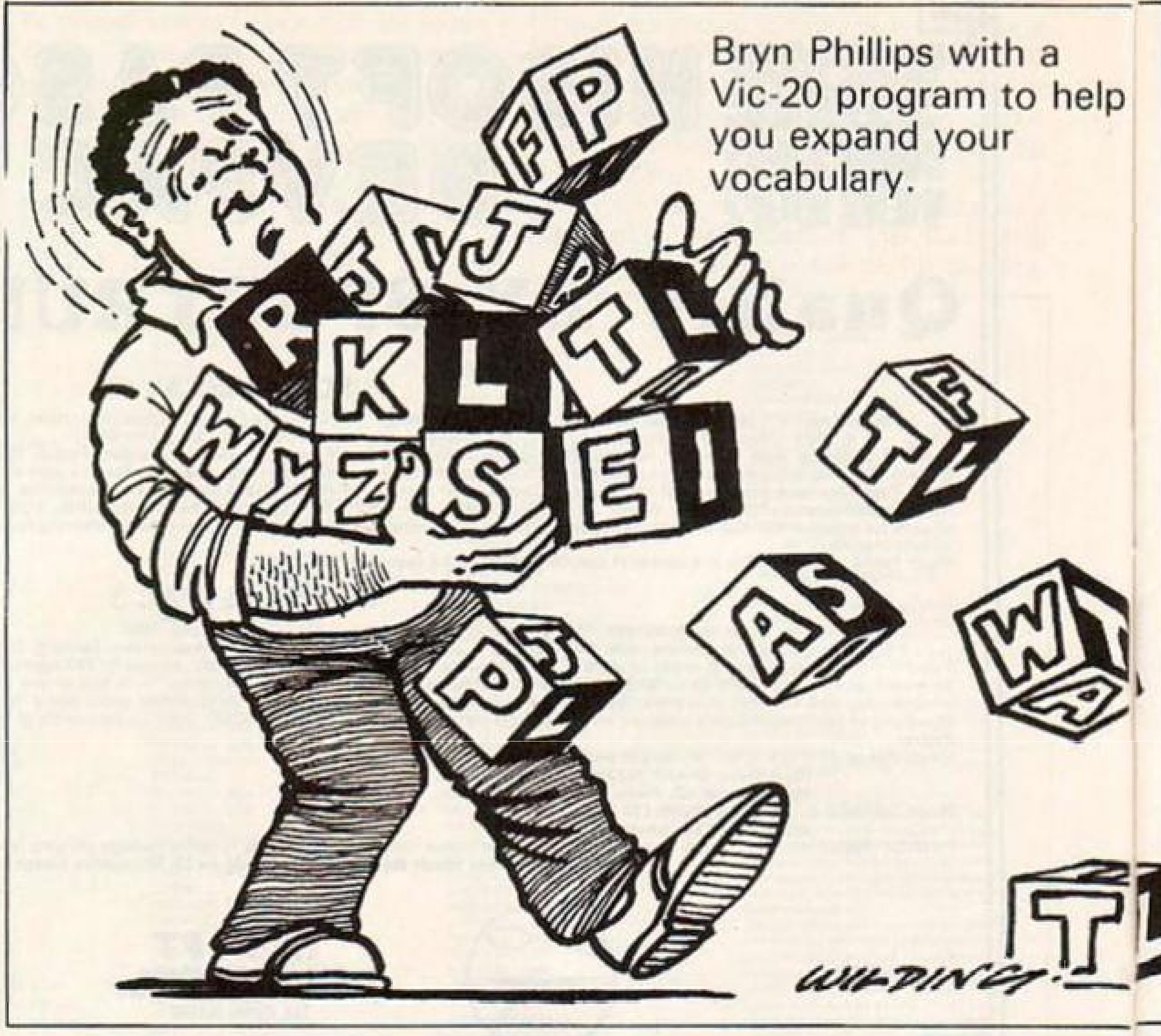
You can either run the program in upper or lower case mode by pressing the Commodore and Shift keys together. Your first option is Easy or Hard. This determines the length of the word. Easy gives a maximum of five letters, and hard a maximum of 10 letters. You then select either a one player or two player game. In the one player game the computer chooses 20 random words, and in the two player game each player chooses 10 words — with the other player out of the room.

Can let computer choose

If desired either or both of the players may let the computer choose the words for them. If the words are entered by the players, they are checked for length and gaps by the computer. Any illegal words must be re-entered.

When the words have been selected the game begins. An area of the screen is drawn out for the letters, and within that area a rectangle is drawn which exactly fits the word. The letters of the word then move about randomly, and if a letter lands in its correct position in the rectangle it changes colour and is fixed. In the one player game the computer gets 1 point for each letter it fixes in this way. When you think you know the word press the space bar — one player game — or Z or / — two player game. The letters then freeze and you are invited to enter your word in a second rectangle.

After you have entered it, press Y to



Bryn Phillips with a Vic-20 program to help you expand your vocabulary.

LETTER DROP

```
10 READW$
20 IFW$="END"THEN50
30 TT=TT+1:GOTO10
50 DIM N$(20):DIMW(20)
60 P1=8164:P2=[illegible]:IFPEEK(644)>32THENP1=4590:P2=30372
70 R=RND(-TI)
80 S1=36875:V=36878:S2=36876
90 POKE36879,26
100 PRINT"LETTER DROP"
102 PRINT"CHOOSE OPTION..."
110 PRINT"EASY OR HARD"
120 GETA$
130 IFA$="E"THENMX=5:MN=2:S$="EASY":GOTO160
140 IFA$="H"THENMX=10:MN=6:S$="HARD":GOTO160
150 GOTO120
160 PRINT" PLAYER GAME"
170 PRINT" PLAYER GAME"
180 GETA$:IFA$=""THEN180
190 G=VAL(A$):IFG<1ORG>2THEN180
200 ONGGOTO570,210
210 PRINT"LETTER DROP"
220 PRINT"EACH PLAYER MUST      ENTER 10 WORDS."
230 PRINT"EACH WORD MUST BE     LESS THAN"MX"LETTERS   LONG"
240 PRINT"PLAYER 1 KEY = Z"
250 PRINT"PLAYER 2 KEY = /"
260 PRINT"PRESS C TO CONTINUE"
270 GETA$:IFA$<>"C"THEN270
280 PRINT"PLAYER 1"
290 PRINT" COMPUTER CHOICE"
300 PRINT" YOUR CHOICE"
310 GETA$:IFVAL(A$)<1ORVAL(A$)>2THEN310
320 IFA$="2"THENGOTO370
330 N1=1:N2=10:GOSUB2140
340 PRINT"PRESS C TO CONTINUE"
350 GETA$:IFA$<>"C"THEN350
360 GOTO410
370 FORI=1TO10
380 PRINTI;:INPUTN$(I)
390 NEXTI
400 N1=1:N2=10:GOSUB1410
410 PRINT"PLAYER 2"
420 PRINT" COMPUTER CHOICE"
430 PRINT" YOUR CHOICE"
440 GETA$:IFVAL(A$)<1ORVAL(A$)>2THEN440
450 IFA$="2"THENGOTO500
460 N1=11:N2=20:GOSUB2140
470 PRINT"PRESS C TO CONTINUE"
480 GETA$:IFA$<>"C"THEN480
490 GOTO540
500 FORI=11TO20
510 PRINTI;:INPUTN$(I)
520 NEXTI
530 N1=11:N2=20:GOSUB1410
540 PRINT"PRESS S.TO START"
550 GETA$:IFA$<>"S"THEN550
560 GOTO740
570 PRINT"COMPUTER LOOKING FOR  SOME "S$" WORDS"
580 FOR I=1TO20
590 PRINT"FOUND"I""
600 RESTORE
610 R=INT(RND(1)*TT-1)+1
620 IFR=0THEN660
630 FORJ=1TOR
640 READW$
650 NEXTJ
660 READN$(I)
670 IFLEN(N$(I))>MXORLEN(N$(I))<MNTHEN600
680 FORH=1TOI-1
690 IFN$(H)=N$(I)ANDI>1THENTS=1
700 NEXTH
710 IFTS=1THENTS=0:GOTO600
720 NEXTI
```

```
730 REM MAIN PROGRAM
740 IFG=1THENT1$="HUMAN":T2$="COMPUTER"
750 IFG=2THENT1$="PLAYER 1":T2$="PLAYER 2"
760 PRINT"■■"TAB(2)T1$;TAB(12)T2$
770 FORX=3TO17
780 FORY=2TO10
790 POKEP1+X-22*Y,102:POKEP2+X-22*Y,2
800 NEXTY,X
810 FORX=4TO16
820 FORY=3TO9
830 POKEP1+X-22*Y,32
840 NEXTY,X
850 FORWN=1TO20
860 PRINT"■■■■■■■■■■■■■WORD "WN
870 R=INT(RND(1)*20)+1
880 TS=0
890 FORJ=1TOWN
900 IFR=W(J)THENTS=1
910 NEXTJ
920 IFTS=1THEN870
930 W(WN)=R
940 W$=N$(R)
950 LN=LEN(W$)
960 FORI=1TOLEN(W$)
970 L$(I)=MID$(W$,I,1)
980 L(I)=ASC(L$(I))-64
990 NEXTI
1000 X1=9-INT(LN/2):X2=X1+LN+1
1010 POKEP1+X1-22*6,103:POKEP2+X1-22*6,5
1020 POKEP1+X2-22*6,101:POKEP2+X2-22*6,5
1030 FORX=X1+1TOX2-1
1040 POKEP1+X-7*22,100:POKEP2+X-7*22,5
1050 POKEP1+X-5*22,99:POKEP2+X-5*22,5
1060 NEXTX
1070 BS=0
1080 FORI=1TOLN
1090 IFL(I)=32THEN1180
1100 X(I)=INT(RND(1)*11)+4:Y(I)=INT(RND(1)*4)+4
1110 PK=PEEK(P1+X(I)-22*Y(I))
1120 IFPK<>32THEN1100
1130 POKEP1+X1(I)-22*Y1(I),32
1140 IFY(I)=6ANDX(I)=I+X1THENGOSUB1640
1150 IFBS=1THENBS=0:GOTO1180
1160 X1(I)=X(I):Y1(I)=Y(I)
1170 POKEP1+X(I)-22*Y(I),L(I):POKEP2+X(I)-22*Y(I),2
1180 GETA$
1190 IFA$=" "THENGOSUB1820
1200 IFA$="Z"ORA$="/"THENGOSUB2260
1210 IFEN=1THENI=LN
1220 NEXTI
1230 IFEN=1THENEN=0:GOTO1250
1240 GOTO1080
1250 FORX=4TO16
1260 FORY=3TO9
1270 POKEP1+X-22*Y,32
1280 NEXTY,X
1290 NB=0
1300 FORI=1TOLN
1310 X1(I)=0:Y1(I)=0
1320 NEXTI
1330 PRINT"■■■■■■                    "
1340 FORI=1TO6:PRINT"                      ":NEXTI
1350 NEXTWN
1360 PRINT"■■■■■■■■■■GAME OVER"
1370 PRINT"■■■■PRESS SPACE BAR"
1380 GETA$:IFA$<>" "THEN1380
1390 RUN
1400 REM CHECK INPUT
1410 ER=1
1420 FORI=N1TON2
1430 LN=LEN(N$(I))
1440 IFLN>MXTHENE$(ER)=N$(I):E(ER)=I:ER=ER+1:GOTO1490
1450 FORJ=1TOLN
1460 MD$=MID$(N$(I),J,1)
1470 IFASC(MD$)<65ORASC(MD$)>90THENE(ER)=I:E$(ER)=N$(I):
     ER=ER+1:J=LN
1480 NEXTJ
1490 NEXTI
1500 IFER=1THENRETURN
1510 PRINT"■■■PLEASE CHANGE THE      FOLLOWING■■"
1520 FORI=1TOER-1
1530 PRINTE(I)","E$(I)
1540 INPUT"■■";N$(E(I))
1550 LN=LEN(N$(E(I)))
1560 IFLN>MXTHEN PRINT"TOO LONG":GOTO1540
1570 FORK=1TOLN
1580 IFMID$(N$(E(I)),K,1)=" "THENGP=1
1590 NEXTK
1600 IFGP=1THENPRINT"NO GAPS!":GP=0:GOTO1540
1610 NEXTI
1620 RETURN
1630 REM*FIX LETTERS*
1640 GOSUB2610
1650 POKEP1+X(I)-22*Y(I),L(I):POKEP2+X(I)-22*Y(I),0
1660 BS=1
1670 FORK=1TO100:NEXT
1680 L(I)=32
1690 CS=CS-1
1700 IFG=1THENPRINT"■■■■■■■■■■■■■■■■■"CS
1710 NB=NB+1
1720 RETURN
1730 LN=LEN(N$(E(I)))
1740 IFLN>6THENPRINT"■■TOO LONG AGAIN!!":GOTO1540
1750 FORJ=1TOLN
1760 MD$=MID$(N$(E(I)),J,1)
1770 IFASC(MID$)<65ORASC(MID$)>90THENFL=1
1780 NEXTJ
1790 IF FL=1THENFL=0:PRINT"NO SPACES ALLOWED!!":GOTO1540
1800 NEXTI
1810 RETURN
1820 IFG=2THENRETURN
1830 GOSUB2810
1840 FORK=1TO5
1850 PRINT"■■■■■■■■■■■■■■"
1860 POKES1,240:POKES2,200:POKEV,15
1870 PRINT"■■■■■■■■■■■■■■■■ENTER WORD"
1880 FORF=1TO100:NEXTF
1890 POKES1,0:POKES2,0:POKEV,0
1900 NEXTK
1910 X=X1+1
1920 IFX>X2-1 THEN1980
1930 GETL$:IFL$=""THEN1930
1940 LT=ASC(L$)-64:IFLT<0THEN1930
1950 G$=G$+L$
1960 POKEP1+X-22*13,LT:POKEP2+X-22*13,6
1970 X=X+1:GOTO1920
1980 PRINT"■■■■■■■■■■■■■■CONFIRM (Y/N)"
1990 GET A$
2000 IFA$="Y"THEN2050
2010 IFA$="N"THEN2030
2020 GOTO1990
2030 GOSUB2070
2040 G$="":GOTO1910
2050 IFG$=W$THENPS=PS+LN-NB:PRINT"■■■■■"PS:EN=1:G$="":GOSUB2690:RETURN
2060 IFG$<>W$THENCS=CS+5:PRINT"■■■■■■■■■■■■■■■■■■"CS:G$="":
     GOSUB2070:GOSUB2750:RETURN
2070 FORX=X1+1TOX2-1
2080 POKEP1+X-22*13,32
2090 NEXTX
2100 PRINT"■■■■■■■■■■■■■               "
2110 PRINT"                        "
2120 RETURN
2130 REM**VIC WORD-SEARCH*
2140 FORI=N1TON2
2150 RESTORE
2160 R=INT(RND(1)*104)
2170 IFR=0THEN2210
2180 FORJ=1TOR
2190 READN$
2200 NEXTJ
2210 READN$(I)
2220 IFLEN(N$(I))>MXORLEN(N$(I))<MNTHEN2150
2230 PRINTI;TAB(4)N$(I)
2240 NEXTI
2250 RETURN
2260 IFG=1THENRETURN
2270 IFA$="Z"THENP$="PLAYER 1":PL=1
2280 IFA$="/"THENP$="PLAYER 2":PL=2
2290 GOSUB2810
2300 FORK=1TO5
2310 PRINT"■■■■■■■■■■■■■■               "
2320 POKES1,240:POKES2,200:POKEV,15
2330 PRINT"■■■■■■■■■■■■■■■■"P$
2340 FORF=1TO100:NEXTF
2350 POKES1,0:POKES2,0:POKEV,0
2360 NEXTK
2370 X=X1+1
2380 IFX>X2-1 THEN2440
2390 GETL$:IFL$=""THEN2390
2400 LT=ASC(L$)-64:IFLT<0THEN2390
2410 G$=G$+L$
2420 POKEP1+X-22*13,LT:POKEP2+X-22*13,6
2430 X=X+1:GOTO2380
2440 PRINT"■■■■■■■■■■■■■■CONFIRM (Y/N)"
2450 GET A$
2460 IFA$="Y"THEN2510
2470 IFA$="N"THEN2490
2480 GOTO2450
2490 GOSUB2070
2500 G$="":GOTO2370
2510 IFPL=2 THEN2560
2520 IFG$=W$THENGOSUB2690:GOTO2540
2530 M2=M2+5:PRINT"■■■■■■■■■■■■■■■■"M2:G$="":GOSUB2070:GOSUB2750:RETURN
2540 IFR>10THENM1=M1+2*(LN-NB):PRINT"■■■■■"M1:EN=1:G$="":RETURN
2550 IFR<11THENM1=M1+(LN-NB):PRINT"■■■■■"M1:EN=1:G$="":RETURN
2560 IFG$=W$THENGOSUB2690:GOTO2580
2570 M1=M1+5:PRINT"■■■■■"M1:G$="":GOSUB2750:GOSUB2070:RETURN
2580 IFR<11THENM2=M2+2*(LN-NB):PRINT"■■■■■■■■■■■■■■■■"M2:EN=1:G$="":RETURN
2590 IFR>10THENM2=M2+(LN-NB):PRINT"■■■■■■■■■■■■■■■■"M2:EN=1:G$="":
     RETURN
2600 REM SOUND EFFECTS
2610 FOREF=5TO50STEP5
2620 POKES2,128+EF+L(I)
2630 FORVL=15TO0STEP-2
2640 POKEV,VL
2650 NEXTVL
2660 NEXTEF
2670 POKES2,0
2680 RETURN
2690 POKEV,15
2700 FORSN=0TO50
2710 POKES2,180+SN
2720 NEXTSN
2730 POKES2,0:POKEV,0
2740 RETURN
2750 POKEV,15
2760 FORSN=50TO0STEP-1
2770 POKES1,128+SN
2780 NEXT SN
2790 POKES1,0:POKEV,0
2800 RETURN
2810 POKEP1+X1-22*13,103:POKEP2+X1-22*13,2
2820 POKEP1+X2-22*13,101:POKEP2+X2-22*13,2
2830 FORX=X1+1TOX2-1
2840 POKEP1+X-22*14,100:POKEP2+X-22*14,2
2850 POKEP1+X-22*12,99:POKEP2+X-22*12,2
2860 NEXTX
2870 RETURN
```

confirm. If you have made a mistake, press n which will clear the word, and allow you to re-enter it. If you are wrong your opponent gets a 5 point bonus, and play resumes. If you are correct, your score increases by the number of letters left unfixed on the screen.

In the two player game you get double the point score if you get your opponent's word. The computer then selects the next word and play continues. The game ends when 20 words have been played.

The program is written entirely in Basic and should present no problems in typing in. The Data statements should be regarded as example words and can be changed if desired, and the list extended to the limit of the computers available memory. It is important to make sure that "END" does not appear anywhere in the list, as this is used at the end of the Data to allow the computer to count up the available words.

If you do not want to type the program in I will send you a cassette containing a copy of the program with a particularly nasty list of words if you send a cheque of P.O. for £3 to: B M Phillips, 12 Eden Drive, Moresby Parks, Whitehaven, Cumbria, CA28 8XA. ■



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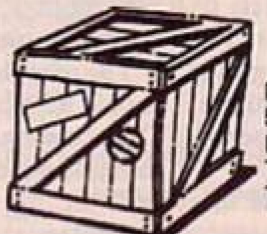
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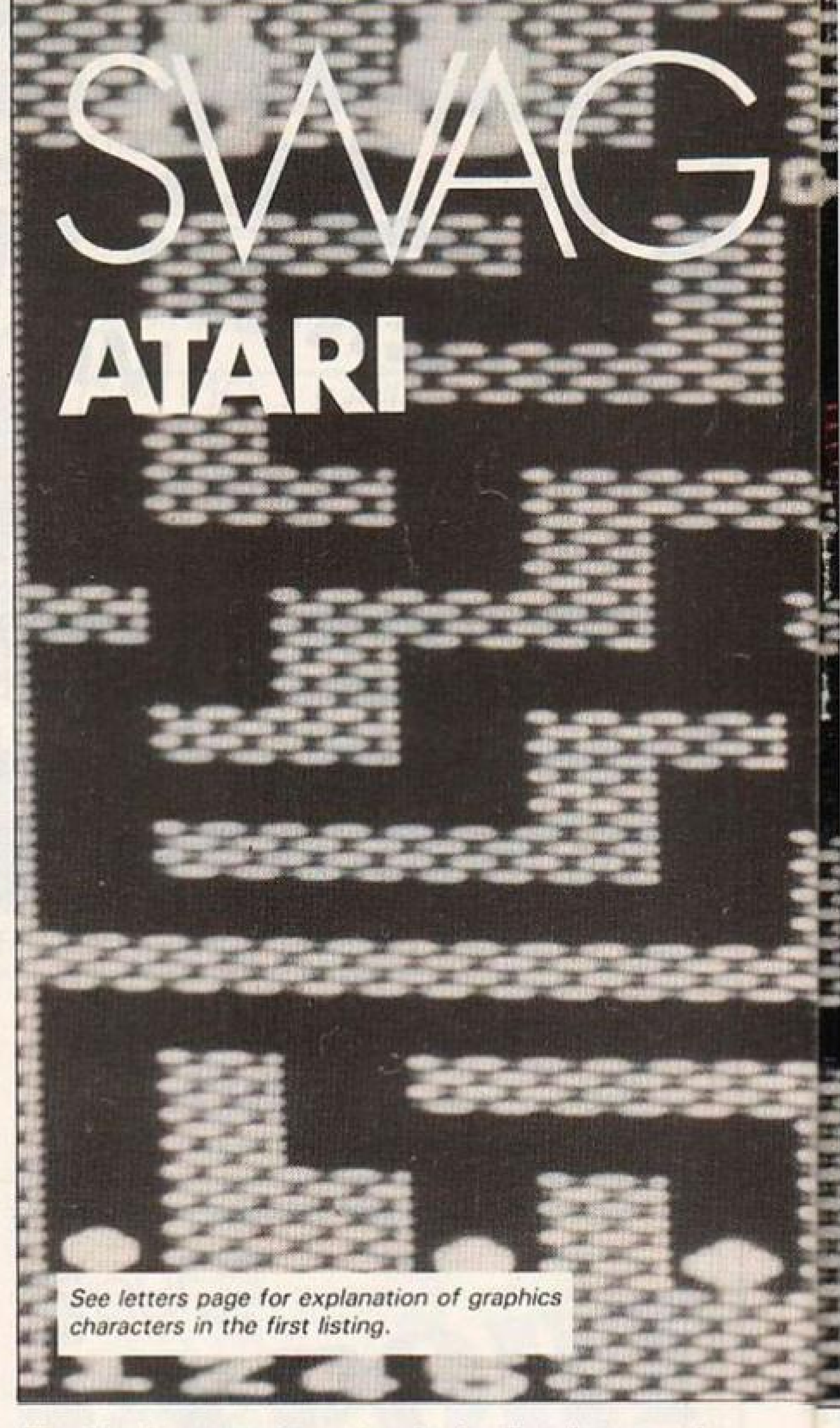


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Get rich quick with G S Fairall's maze game for the Atari. But watch out for the guard and his dog. If they catch you then you will explode on contact.

```
1 DIM P(4),M$(32)
2 GRAPHICS 0
5 ? :? :? "LOADING DATA FOR":? :? "          S W A G ":? :? "BY GRAHAME FAIRALL"
10 FOR I=1 TO 32:READ A:M$(I)=CHR$(A):NEXT I
11 DATA 104,104,133,204,104,133,203,104,133,206,104,133,205,162,4,160,0,177,203,
145,205,136,208,249,230,204
12 DATA 230,206,202,208,240,96
20 P=PEEK(106)-4:FOR I=1 TO 4:P=P-4:P(I)=P:NEXT I
22 FOR I=1 TO 4:P=P(I)*256:A=USR(ADR(M$),57344,P):NEXT I
25 RESTORE 9000:FOR I=8 TO 111:READ A:POKE P(1)*256+I,A:NEXT I
30 FOR I=8 TO 111:READ A:POKE P(2)*256+I,A:NEXT I
35 FOR I=8 TO 111:READ A:POKE P(3)*256+I,A:NEXT I
40 FOR I=8 TO 111:READ A:POKE P(4)*256+I,A:NEXT I
100 GRAPHICS 17:POKE 708,12:POKE 709,54:POKE 710,252:POKE 711,70:POKE 756,P(1)
110 ? #6;"!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!";
111 ? #6;"!!!!!!!!!!!!!!!!!!!!!!!!!";
112 ? #6;"by grahame fairall";
113 ? #6;" SWAGMAN ! GUARDWITH KEY %WITH GOLD,  DOG ";
114 ? #6;" KEYHOLE   KEY (SAFE ZONE$SAFE GOLD" GOLD ";
115 ? #6;"1  GET KEY 2 OPEN LOCK3 TAKE GOLD4 GOTO ZONE";
116 ? #6;"please wait";
200 FOR I=1 TO 4:POKE 756,P(I):FOR J=1 TO 20:NEXT J:NEXT I:X=X+1:IF X<=20 THEN G
OTO 200
210 POKE 764,12:CLOAD
9000 DATA 238,0,187,0,238,0,187,0
9001 DATA 54,28,50,111,71,111,99,62
9002 DATA 0,224,160,191,165,229,0,0
9003 DATA 255,231,195,195,195,231,231,255
9004 DATA 24,44,124,60,24,20,162,68
9005 DATA 24,52,62,60,24,40,69,34
9006 DATA 56,84,124,108,56,104,8,12
9007 DATA 0,0,0,24,24,0,0,0
9008 DATA 28,52,28,4,4,4,42,17
9009 DATA 56,44,56,32,32,32,84,136
9010 DATA 62,42,62,8,127,8,22,48
9011 DATA 0,0,50,97,190,126,38,37
9012 DATA 0,0,76,134,125,126,100,164
10000 DATA 221,0,119,0,221,0,119,0
10001 DATA 54,28,50,111,71,111,99,62
10002 DATA 0,224,160,191,170,234,0,0
10003 DATA 255,231,195,195,195,231,231,255
10004 DATA 24,44,124,60,24,24,20,52
10005 DATA 24,52,62,60,24,24,36,22
10006 DATA 56,84,124,108,56,44,32,96
10007 DATA 0,0,24,36,36,24,0,0
10008 DATA 28,52,28,4,12,4,22,10
10009 DATA 56,44,56,32,48,32,104,80
10010 DATA 62,20,62,104,28,11,52,6
10011 DATA 0,0,50,97,190,126,36,36
10012 DATA 0,0,76,134,125,126,36,36
11000 DATA 187,0,238,0,187,0,238,0
11001 DATA 54,28,50,111,71,111,99,62
11002 DATA 0,224,160,191,164,228,0,0
11003 DATA 255,231,195,195,195,231,231,255
11004 DATA 24,44,124,60,24,24,8,24
11005 DATA 24,52,62,60,24,24,16,24
11006 DATA 56,84,124,108,56,104,8,12
11007 DATA 0,24,36,66,66,36,24,0
11008 DATA 28,52,28,4,28,4,4,12
11009 DATA 56,44,56,32,56,32,32,48
11010 DATA 62,42,62,8,127,8,52,6
11011 DATA 0,0,49,97,190,126,37,72
11012 DATA 0,0,140,134,125,126,164,18
12000 DATA 119,0,221,0,119,0,221,0
12001 DATA 54,28,50,111,71,111,99,62
12002 DATA 0,224,160,191,170,234,0,0
12003 DATA 255,231,195,195,195,231,231,255
12004 DATA 24,44,124,60,24,24,36,52
12005 DATA 24,52,62,60,24,24,36,22
12006 DATA 56,84,124,108,56,44,32,96
12007 DATA 24,36,66,129,129,66,36,24
12008 DATA 28,52,28,4,12,4,22,10
12009 DATA 56,44,56,32,48,32,104,80
12010 DATA 62,20,62,11,28,104,22,48
12011 DATA 0,0,49,97,190,126,36,36
12012 DATA 0,0,140,134,125,126,36,36
```



See letters page for explanation of graphics characters in the first listing.

How to steal a million dollars: this is computer crime with a difference — you play the part of a burglar who is a nonchalant and nondescript as a man can be when he is bright purple. When you are carrying nothing you are purple, when you are carrying a key you will be red, and when you are carrying gold you will be yellow.

Swag is a maze game. The object is to get the gold from the top of the screen to the bottom where there are flashing safe zones. A lot of factories have signs outside them saying "Guard dog patrol" and it is just a big bluff. It turns out to be for real in this case.

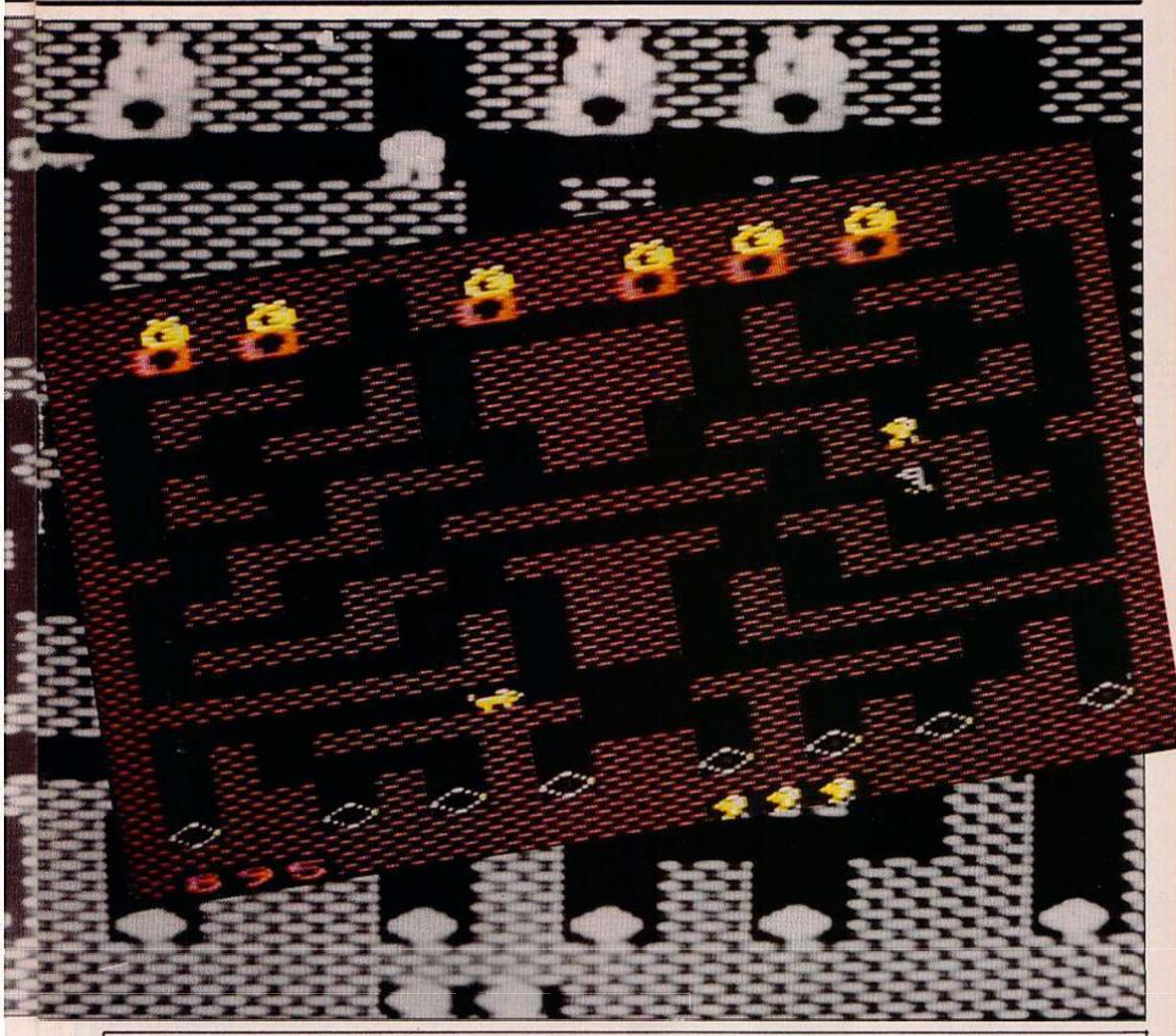
The game, which requires a joystick, uses four sets of redefined characters which are alternated to give the effect of movement in a graphics 1/2 screen. The program is in two parts. The first redefines the character set, the second is the actual game. Type in the first program first, Save it by typing:

SAVE":C"

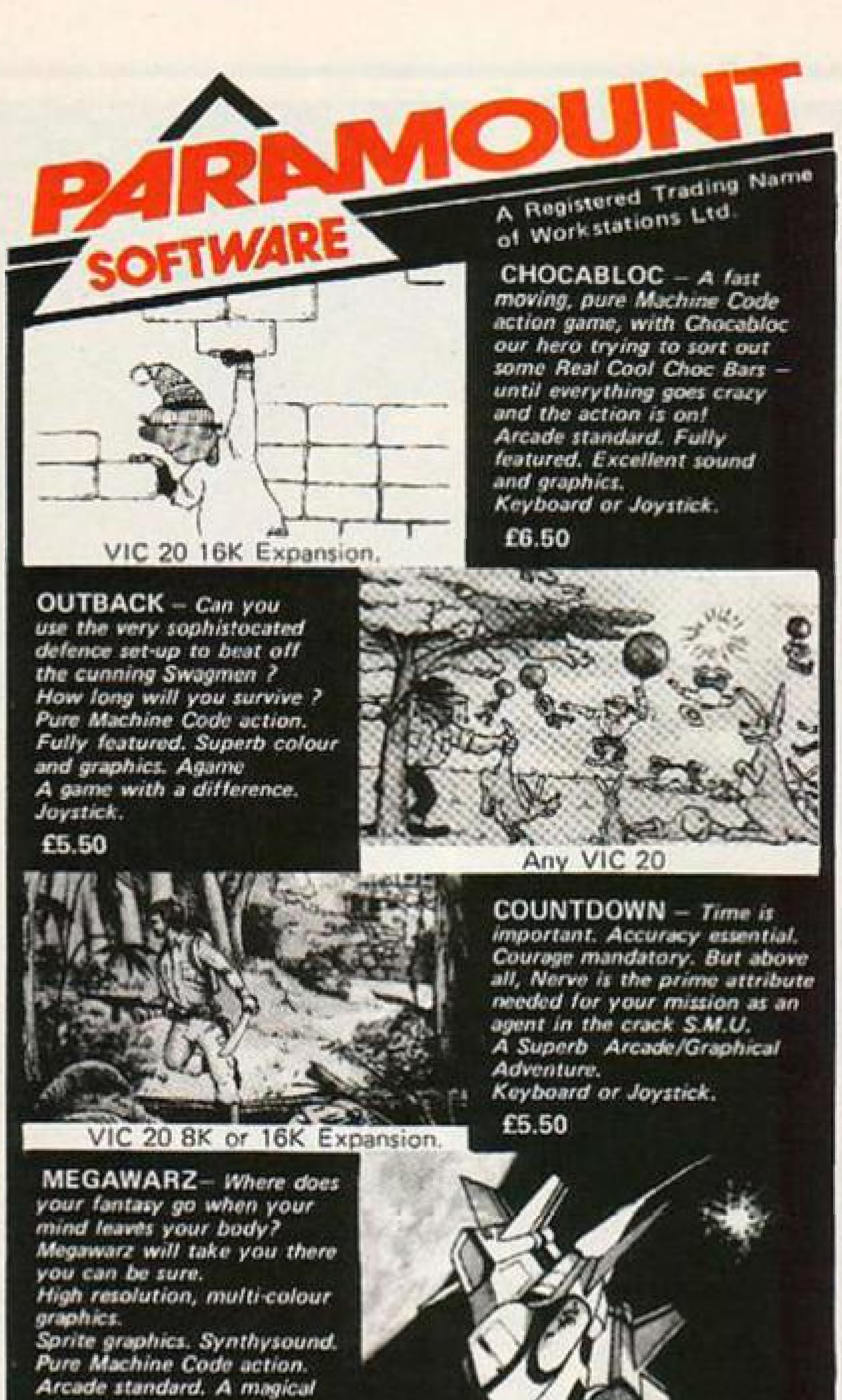
Type in the second program. Save it with:

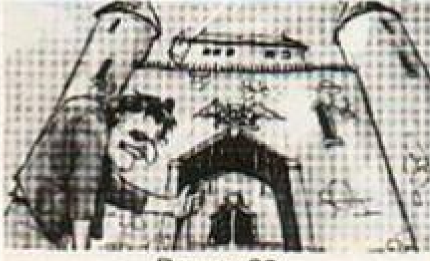
CSAVE

```
1 DIM C(15),P(4),C712(14)
3 FOR I=1 TO 15:C(I)=125:NEXT I:C(5)=134:C(6)=134:C(7)=134:C(9)=133:C(10)=133:C(
11)=133
10 RESTORE 12:FOR I=1 TO 14:READ A:C712(I)=A:NEXT I
12 DATA 0,42,90,170,250,219,122,186,100,58,160,106,224,26
20 P=PEEK(106)-4:FOR I=1 TO 4:P=P-4:P(I)=P:NEXT I:GOTO 100
50 IF SK<0.4 THEN RETURN
51 FOR I=1 TO (SK-0.9)*10:Z=RND(0):COLOR 11
52 XX=RND(0)*18+1:YY=RND(0)*14+3:LOCATE XX,YY,XZ:IF XZ=6 OR XZ=32 THEN PLOT XX,Y
Y:NEXT I:RETURN
53 GOTO 52
99 INPUT A:POKE 712,A:GOTO 99
100 GRAPHICS 17:POKE 756,P(3)
101 POKE 708,54:POKE 709,12:POKE 710,252
105 LI=5:A=10:B=3:SK=0.1:SC=0:CD=0:COL=1:EM=15000:POKE 712,C712(COL)
110 POKE 712,C712(COL):COLOR 33:PLOT 0,0:DRAWTO 19,0:DRAWTO 19,22:DRAWTO 0,22:DR
AWTO 0,0
111 POSITION 1,1:? #6;"'''''''''''''''''''''":POSITION 1,2:? #6;"'!'!'!'!'!'!'!'!'!'
"
112 POSITION 2,4:? #6;"!!! ! !!!! ! !!!":POSITION 2,5:? #6;"!   ! !!!! !   !":PO
SITION 10,3:? #6;"#"
113 POSITION 4,6:? #6;"!!! !!!! !!!":POSITION 2,7:? #6;"!      !!      !":POSITI
ON 2,8:? #6;"!!! !!! !! !!! !!!"
114 POSITION 5,9:? #6;"!     !":POSITION 1,10:? #6;"! !!! !!!!!! !!! !":POSITI
ON 3,11:? #6;"!          !"
115 POSITION 2,12:? #6;"!! !! !!!! !! !!":POSITION 5,13:? #6;"!    !!    !":POSITI
ON 1,14:? #6;" !!!! ! !! ! !!!!"
116 POSITION 7,15:? #6;"! !! !":POSITION 1,16:? #6;"!!!!!!!! !! !!!!!!!"
117 POSITION 2,18:? #6;"! !!!!!  !!!!! !":POSITION 2,19:? #6;"!    !    !    !!"
118 POSITION 2,20:? #6;"!! ! ! !! ! ! !!":POSITION 1,21:? #6;"'''''''''''''''''"
119 POSITION 0,23:? #6;"!!!!!!!!!!!!!!!!!!!!!!!";:IF SK>0.1 THEN GOSUB 50:GOTO 126
120 POSITION 4,11:? #6;"press  start"
121 FOR I=1 TO 4:POKE 756,P(I):FOR J=0 TO 4:IF PEEK(53279)=6 THEN 126
122 IF I=3 THEN SOUND 0,200,8,10
125 NEXT J:SOUND 0,0,0,0:NEXT I:GOTO 121
126 COLOR 165:FOR I=1 TO LI:PLOT 10+I,23:NEXT I:POSITION 1,23:? #6;SC
130 POSITION 4,11:? #6;" get  ready ":RESTORE 135:FOR I=1 TO 11:READ J:SOUND 0,J
,10,10:FOR K=1 TO 40:NEXT K:NEXT I
132 X=9:Y=9:K=0:M=0:D=0:Q=0:U=10:V=11:II=1:DOG=9:DD=-1:CD=172:DC1=0:F1=11:V1=11:
F1A=12:F2A=11:W1=0
133 O=0
134 COLOR 135:PLOT X,Y:COLOR 11:PLOT U,V:COLOR C2:PLOT DOG,17:COLOR 35:PLOT A,B
135 DATA 81,91,96,108,121,121,81,81,121,121,0
140 POSITION 5,11:? #6;"          "
200 S=STICK(0):X1=(S=5 OR S=6 OR S=7)-(S=9 OR S=10 OR S=11):Y1=(S=13)-(S=14)
202 SOUND 1,0,0,0:Q=Q+1:POKE 756,P(Q):IF Q=4 THEN Q=0:SOUND 1,200,8,10
```



```
205 IF X1=0 AND Y1=0 THEN S=SS:GOTO 230
210 LOCATE X+X1,Y+Y1,Z:IF Z<>0 AND Z<>32 THEN SOUND 1,0,0,0:GOSUB 300
220 COLOR 0:PLOT X,Y:X=X+X1:Y=Y+Y1:COLOR C(S)+D:PLOT X,Y:SS=S:SC=SC+5
222 POSITION 1,23:? #6;SC
230 DOG=DOG+DD:LOCATE DOG,17,DC:COLOR DC1*(W1<9 OR W1>11):PLOT DOG-DD,17
231 IF DOG>=16 OR (DOG<14 AND RND(0)<0.1) THEN DD=-1:CD=172
232 IF DOG<=3 OR (DOG>5 AND RND(0)<0.1) THEN DD=1:CD=173
233 IF X=DOG AND Y=17 THEN 500
234 COLOR CD:PLOT DOG,17:DC1=DC
240 U1=(INT(U)<X)-(INT(U)>X):IF U1=0 THEN V1=(INT(V)<Y)-(INT(V)>Y)
241 LOCATE U+U1,V+V1,W:IF W=33 THEN GOSUB 280
242 LOCATE U+U1,V+V1,W:IF W=35 THEN Z=W:GOSUB 350:COLOR 0:PLOT U+U1,V+V1:W=0
243 COLOR W1*(W1<9 OR W1>11)*(W1<>CD):PLOT U,V:U=U+U1:V=V+V1:COLOR (U1>0)*10+(U1
<0)*9+(V1<>0 AND U1=0)*11
244 PLOT U,V:W1=W:F1A=F1:F2A=F2:F1=U:F2=V:IF INT(U)=X AND INT(V)=Y THEN 500
245 GOTO 200
280 IF RND(0)<0.01 THEN COLOR 0:PLOT A,B:Z=35:GOSUB 350
281 LOCATE U+1,V,W:IF W<>33 AND U+1<>F1 AND U+1<>F1A THEN U1=SK:V1=0:RETURN
282 LOCATE U-1,V,W:IF W<>33 AND U-1<>F1 AND U-1<>F1A THEN U1=-SK:V1=0:RETURN
284 LOCATE U,V+1,W:IF W<>33 AND V+1<>F2A THEN U1=0:V1=SK:RETURN
286 LOCATE U,V-1,W:IF W<>33 AND V-1<>F2A THEN U1=0:V1=-SK:RETURN
290 GOTO 200
300 IF Z=33 THEN X1=0:Y1=0:POP :GOTO 230
301 IF Z=36 AND K=1 AND M<>1 AND O=0 THEN FOR I=1 TO 10:SOUND 0,I,8,10:NEXT I:SO
UND 0,0,0,0:D=0:K=0:O=1:RETURN
302 IF (Z=36 AND K<>1) OR (Z=8 AND M<>1) OR (Z=36 AND M=1) OR (Z=36 AND O=1) OR
Z=4 THEN X1=0:Y1=0:GOTO 230
303 IF Z=35 THEN K=1:FOR I=100 TO 0 STEP -10:SOUND 0,I,10,10:NEXT I:GOSUB 350:D=
-96+(M=1)*128:RETURN
304 IF Z=162 THEN M=1:FOR I=-20 TO 20:SOUND 0,20-ABS(I),10,10:NEXT I:D=32:SC=SC+
100:RETURN
305 IF Z=8 AND M=1 THEN COLOR 162:PLOT X,Y+Y1:COLOR 4:PLOT X,Y:Y=Y-1:Y1=0:D=O+(K
=1)*-96:M=0:O=0:GOSUB 352:RETURN
310 IF Z=9 OR Z=10 OR Z=11 OR Z=CD THEN 500
349 RETURN
350 A=RND(0)*18+1:B=RND(0)*19+1:LOCATE A,B,C:IF C=0 OR C=32 THEN COLOR Z:PLOT A,
B:RETURN
351 GOTO 350
352 SC=SC+200:POSITION 1,23:? #6;SC:RESTORE 355:FOR I=1 TO 9:READ J:SOUND 0,J,10
,10:FOR L=1 TO 20:NEXT L:NEXT I
353 CD=CD+1:IF CD=8 THEN POP :POP :GOTO 600
354 RETURN
355 DATA 136,102,76,68,68,76,68,68,0
500 COLOR 135:PLOT X,Y:FOR I=50 TO 200 STEP 2:SOUND 0,I,8,10:SOUND 1,I-40,8,10:P
OKE 711,I:NEXT I
510 SOUND 0,0,0,0:SOUND 1,0,0,0:POKE 711,70:IF M=1 THEN CD=CD+1
512 COLOR 33:PLOT 10+LI,23:LI=LI-1:IF CD=8 THEN 600
515 IF LI=0 THEN 550
520 COLOR 0:PLOT X,Y:PLOT U,V:PLOT DOG,17:PLOT A,B
530 GOTO 130
550 POSITION 5,11:? #6;"game  over":RESTORE 560:FOR I=1 TO 27:READ J:SOUND 0,J,1
0,10:FOR K=1 TO 20:NEXT K:NEXT I
552 IF SC>HI THEN HI=SC
555 POSITION 0,22:? #6;"! score ";SC:POSITION 0,23:? #6;"! high  ";HI
560 DATA 60,53,47,47,60,60,53,47,45,45,53,53,40,42,40,42,40,42,40,42,40,40,64,64
,60,60,0
570 FOR I=0 TO 1000:NEXT I:GOTO 100
600 COLOR 0:PLOT X,Y:PLOT U,V:PLOT DOG,17:PLOT A,B
602 PO=4:POSITION 4,11:? #6;"BONUS X 1000":FOR I=1 TO 19:LOCATE I,21,J
603 IF J=162 THEN PO=PO+1:POSITION PO,17:? #6;"*":SOUND 0,60,8,10:FOR J=0 TO 20:
NEXT J:SOUND 0,0,0,0:GOSUB 610
605 NEXT I:GOTO 615
610 POSITION I,21:? #6;" ":SC=SC+1000:POSITION 1,23:? #6;SC:FOR J=0 TO 30:NEXT J
:RETURN
615 POSITION 4,11:? #6;" lives left "
620 FOR I=1 TO LI:COLOR 33:PLOT 10+I,23:COLOR 133:PLOT I*2+2,3:FOR J=50 TO 0 STE
P -5:SOUND 0,J,10,10:NEXT J
621 SOUND 0,0,0,0:SC=SC+(SK*2000-100):POSITION 1,23:? #6;SC:FOR J=1 TO 50:NEXT J
:NEXT I
622 IF SC>EM THEN LI=LI+1:GOSUB 630:EM=EM+15000:GOTO 622
625 SOUND 0,0,0,0:SOUND 1,0,0,0:CD=0:SK=SK+0.1:A=10:B=3:GOTO 650
630 POSITION 4,11:? #6;" extra life ":FOR I=50 TO 10 STEP -1:SOUND 0,I,10,10:SOU
ND 1,I+10,10,10:NEXT I
640 RETURN
650 COL=COL+1:IF COL=15 THEN COL=1
652 COLOR 0:FOR I=0 TO 23:PLOT 0,I:DRAWTO 19,I:FOR J=0 TO 2:NEXT J:NEXT I:IF LI=
0 THEN 550
654 GOTO 110
```





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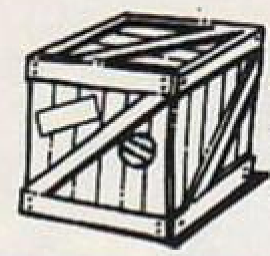
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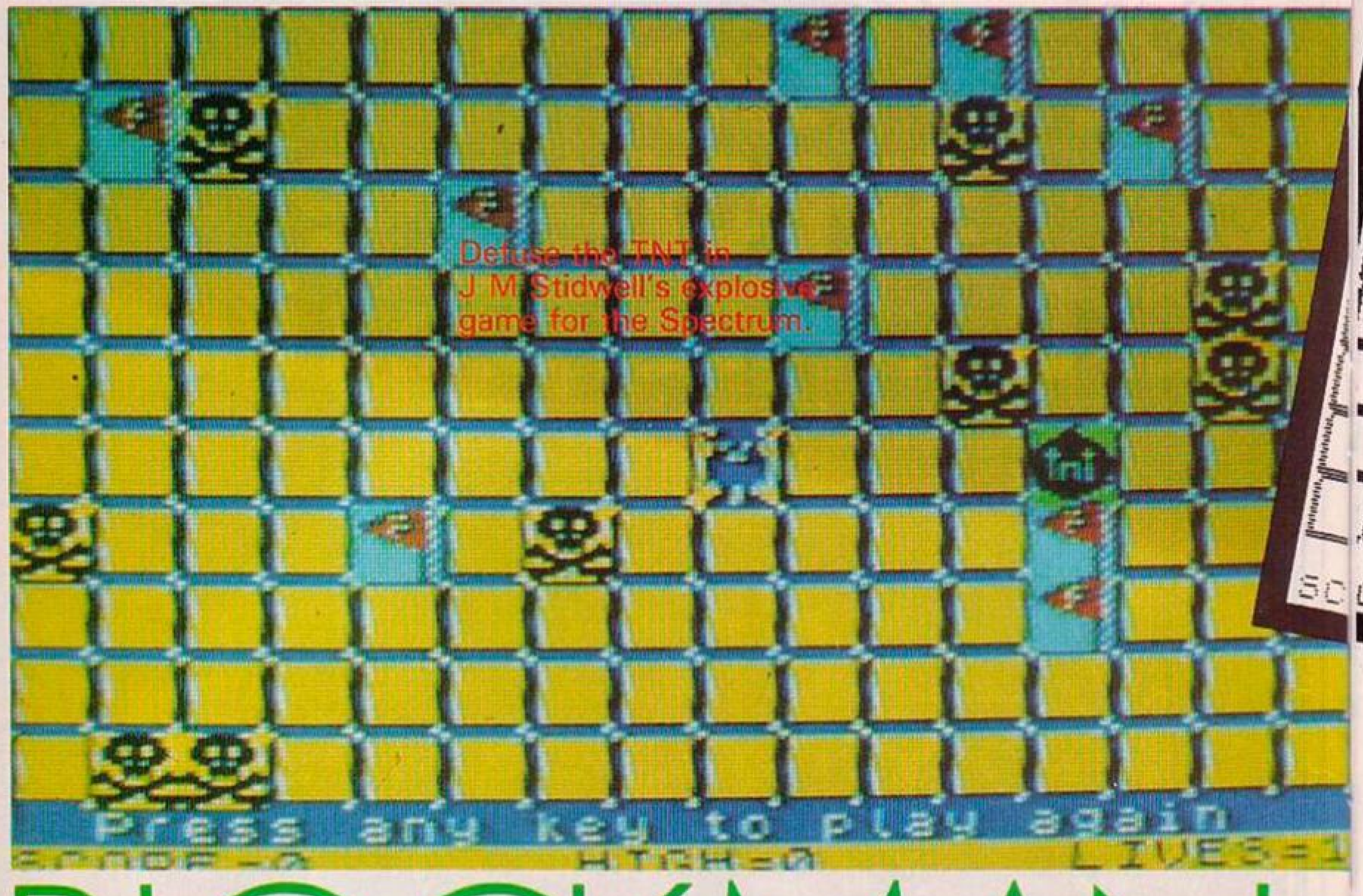
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BLOCKMAN

Variables.

x$ and Y$ = Data for Funeral March
1v = Lives
1 = Level
hs = High score
sc = Current score
x = X position of man
y = Y position of man
b$ = Possible key presses (line 50)
i = Initial time on linear scale
j = Time left on linear scale
a$ = Last key pressed
d = Numerical representation of key press
n = 0 used to Save memory

Program layout.

1 to 116 = Set up screen
117 to 300 = Main program
1000 = Wrap around screen calculation subroutine
4000 to 4110 = Stage Two subroutine
5000 to 5020 = Time up
6000 to 6040 = TNT defused
7000 to 7070 = Landed on skull
8000 to 8220 = Instructions
8230 to 8270 = Set level
9000 to 9300 = Initialisation of graphic characters and machine code

Graphics characters.

A to D = Man
E to G = Skull
H to L = Flag
M to P = Tomb

Line 70 — Graphics MO & NP
Line 75 — Graphics EG & FH
Line 100 — Graphics IK & JL
Line 115 — 32 × Graphics Shift 8
Line 120 — Graphics AB & CD
Line 4000 — 16 × (Graphics EG) & 16 × (Graphics FH)
Line 4005 — Graphics MO & NP
Line 4050 — Graphics AB & CD
Line 4100 — Graphics AB & CD
Line 6000 — Graphics EG & FH
Line 7010 — Graphics QS & RT

Written by J M Stidwill copyright
Graphics by P A Booth copyright

THIS ADDICTIVE game is written for the 16/48K ZX Spectrum. Your man has been placed on the game grid and has to defuse the TNT which explodes when the linear scale shows that your time is up. If your man has not reached the TNT by then, he will lose one of his three lives.

Placed around the grid are various obstacles and bonuses. These are in the form of deadly skulls and flags. On colliding with a skull you will lose a life to the sound of Chopin's Funeral March, and a tomb will put in his place. The flags gain you 150 points each.

At the end of stage 1 five bombs have been defused for 1000 points each. Stage 2 is then reached. This involves very quick reactions!! You must guide your man to the flag, avoiding the skulls. This is done by pressing any key when he is above the flag. All the time, your man is moving across the screen from left to right getting lower and lower, however, the longer you take the lower your bonus — up to a maximum of 4000 points.

The controls are: Z-left; X-right; P-up; L-down.

With these controls, your man destroys the blocks that he passes over, and thus cannot travel over the holes left behind him. When you do not want to destroy the blocks you pass over — for passing over a block you get 10 points — so that you do not hit a skull, or if you have cut yourself off, then you can use two special controls. These are A which scrolls the whole row left and S which scrolls the whole row right.

The game contains three machine-code routines controlling the scrolling movements described above. The first is stored at address 32084. This controls the two other machine code routines, one which scrolls to the right — from address 32000 — and the other which scrolls to the left — from address 32042.



So that this program will run on a 16K ZX Spectrum, economising techniques must be used. The two methods used are:

■ The replacement of all occurrences of the number 0 with the letter variable n — given te value of 0. This Saves five bytes each time it is used as it takes just one byte as opposed to the six needed to store a real number.

■ This involves replacing all large numbers with its exponential value. For example 4e3=4×10 to the power of 3.

ERRATA: The last four numbers of Line 9050 should reach: 96, 96, 120, 124 and not: 96, -4, 120, 124.

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All games 16K unless otherwise stated

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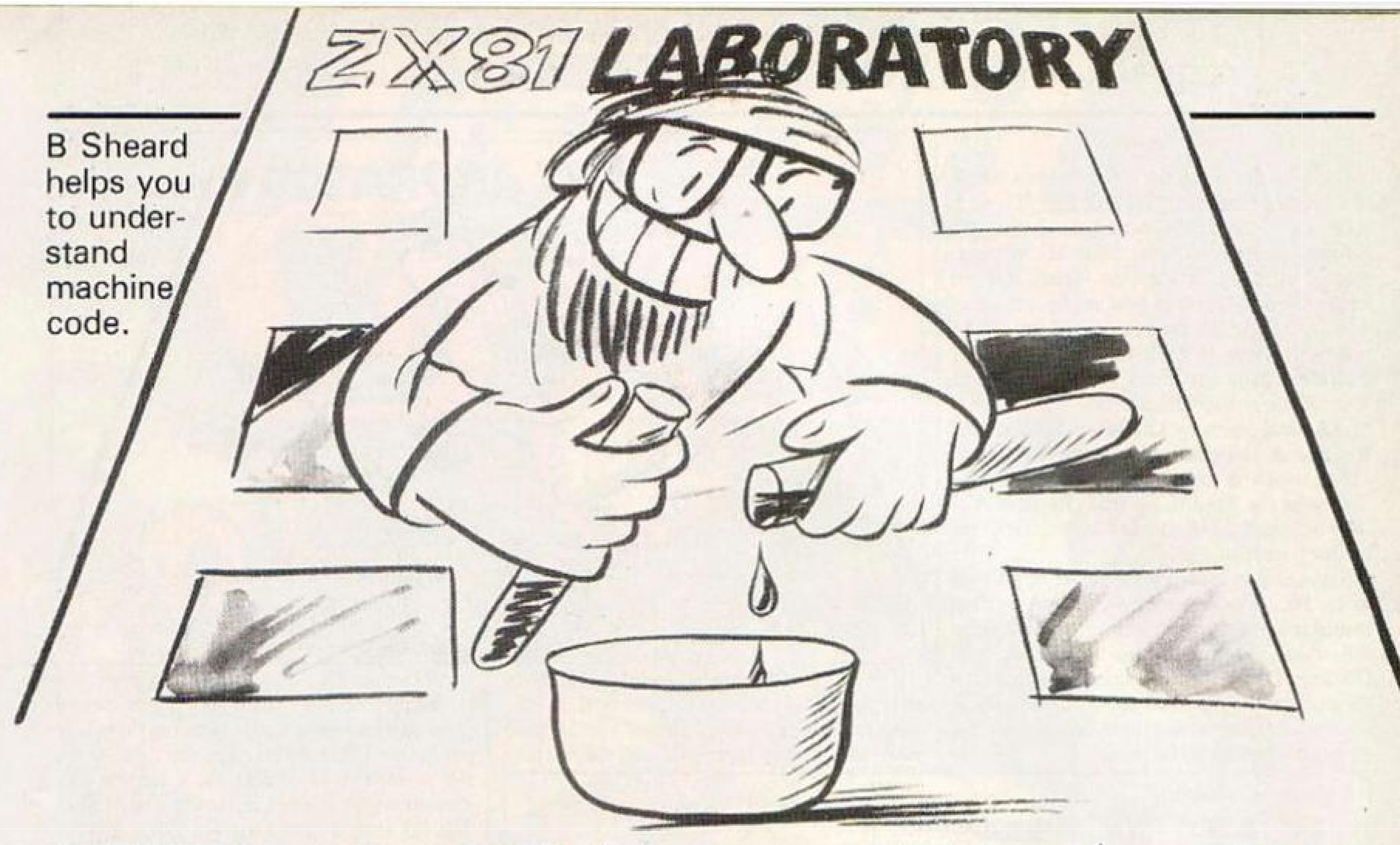
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ZX-81 READ

Basic program.

```
1 REM 126 ZEROS THEN LOAD M/C
2 REM DATA,DATA,DATA,.
3 DIM A$(?)
4 LET RESTORE=16534
5 LET READ=16541
6 LET A=USR RESTORE
7 LET WORD=16522
          TO READ
          -------
10 LET A=USR READ
20 LET C$=A$(TO PEEK WORD)
C$ THEN CONTAINS THE DATA
          TO RESTORE
          ----------
10 LET A=USR RESTORE
THE DATA POINTER IS NOW SET TO
THE BEGINING OF DATA
```

THIS ARTICLE IS designed to help readers who are learning machine code to a better understanding of the principles behind the language.

By using Restore at the beginning of the Basic program this program first sets memory locations 16520/16521 to the beginning of the data in the second Rem statement via Reg Pair HL.

When you give the instruction to read data the program then loads the beginning of the variable area into Register Pair DE.

DE is then incremented six times so that they point to the first memory location for the word in a$. Memory locations 16518/16519 are then loaded ith DE so leaving registers D and E free.

Register A is then loaded with 0 and memory location 16522 which is the count for how many letters are in the word being read is then loaded with A thus setting the count to 0.

HL is then loaded with the start location of data in the second Reh statement then Reg D is loaded with the byte of data pointed to by HL, Reg A is loaded with the code for a comma and compared with register D, if a match is found the program then adds one to the Register Pair HL which then points to the first letter of the next word of data, the location is then loaded into memory locations 16520/16521.

If no match is found the program goes to the next instruction which loads Register A with the code for a full stop and then compares with Register D.

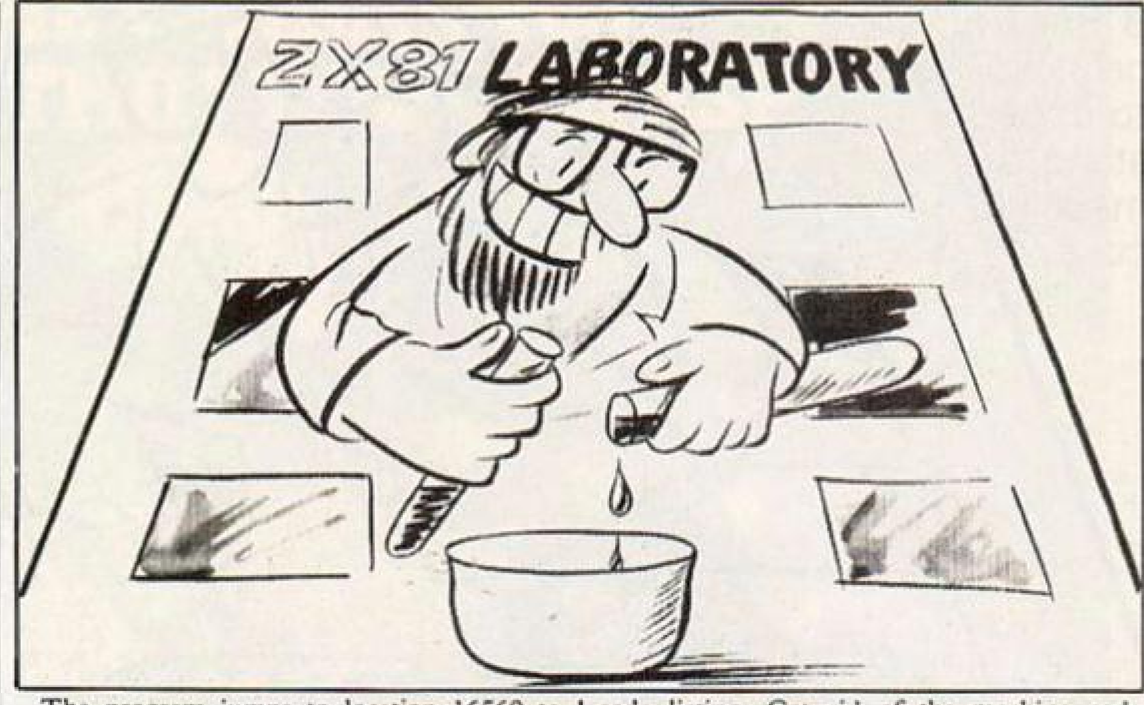
(continued on next page)

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If a match is found the program then jumps to a routine that loads Register Pair HL with locations 16396/16397 which hold the last memory location of Basic. Then HL is incremented to point to the first screen location where the program then goes on to print out of data in the top left-hand corner of the screen before returning to Basic.

If a match is not found the program then loads Register Pair DE with the start location of A$ from memory locations 15516/16519. Register A is loaded with memory location 16522 which is the count for the number of 'letters in the word being read. Register A is then incremented by one and loaded back into memory location 16522.

Register A is loaded with the letter pointed to by HL. The letter in Register A is then loaded into the memory location pointed to by DE which is a memory location in A$, both DE and HL are then incremented to point to the next memory location to be worked on and the registers are loaded into their respective memory locations to be Saved.



The program jumps to location 16560 to start the whole checking process over.

After entering 1 Rem followed by 126 zeros enter the loader program and load the machine code listing. Get rid of the machine code loaded by entering 10 then Newline to the end of the machine-code loader. The next step is to put in line 2 Rem followed by the data. At the end of each word of data put a comma e.g.: Rem Brian, Lyn, The Cat Sat On The Mat'. A data list should always have a full stop after the last comma.

Set up variables

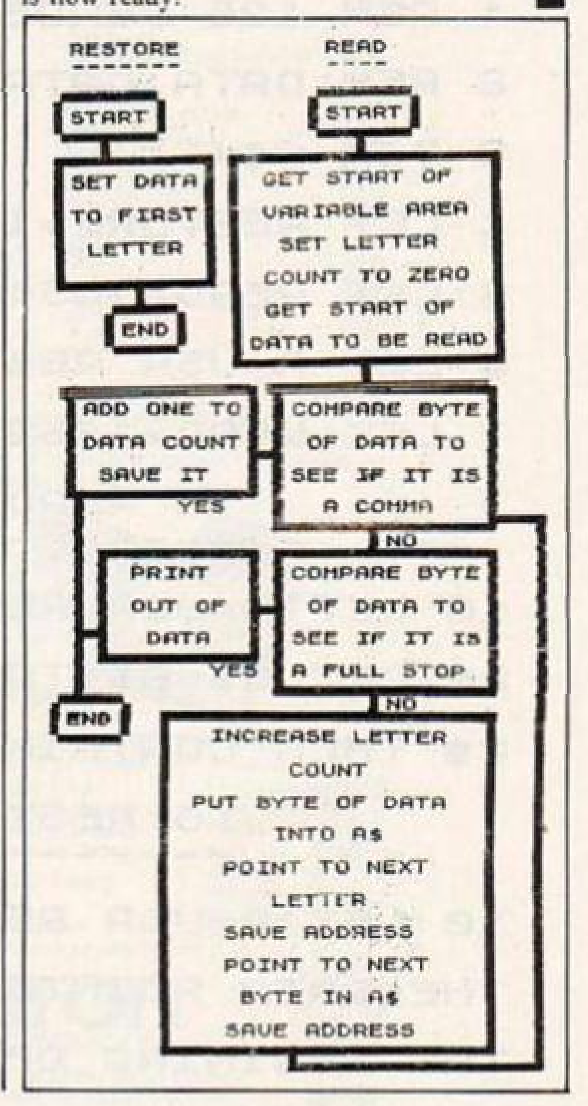
The next thing to do is to dim A$ with the number of letters in the longest word or phrase including the spaces in the phrase. Set up three variables restore with 16534 read with 16541 word with 16522: from then on instead of remembering which memory locations to send USR to just use the appropriate instruction. You must then use line 6 to set the program to the beginning of data, the program is now ready. ■

Machine code loader.

```
10 LET A=16514
20 INPUT C$
30 IF C$="S" THEN STOP
40 PRINT A;"2SPC";C$,
50 POKE A,16*CODE C$+CODE C$(2)-
476
60 LET A=A+1
70 GOTO 20
```

Machine code listing.

```
16514 TO 16533      00
16534 LD HL,16646   21 06 41 RES-
16537 LD(16520)HL   22 88 40 TORE
16540 RET           C9
16541 LD DE(16400)  ED 5B 10 40 R
16545 INC DE        13          EAD
16546 INC DE        13
16547 INC DE        13
16548 INC DE        13
16549 INC DE        13
16550 INC DE        13
16551 LD(16518)DE   ED 53 86 40
16555 LD A,0        3E 00
16557 LD(16522)A    32 8A 40
16560 LD HL(16520)  2A 88 40
16563 LD D(HL)      56
16564 LD A,26       3E 1A
16566 CPD           BA
16567 JRZ +29       28 1D
16569 LD A,27       3E 1B
16571 CPD           BA
16572 JRZ +29       28 1D
16574 LD DE(16518)  ED 5B 86 40
16578 LD A(16522)   3A 8A 40
16581 INC A         3C
16582 LD(16522)A    32 8A 40
16585 LD A(HL)      7E
16586 LD(DE)A       12
16587 INC DE        13
16588 INC HL        23
16589 LD(16520)HL   22 88 40
16592 LD(16518)DE   ED 53 86 40
16596 JR -38        18 DA
16598 INC HL        23
16599 LD(16520)HL   22 88 40
16602 RET           C9
16603 LD HL(16396)  2A 0C 40
16606 INC HL        23
16607 LD(HL)52      36 34
16609 INC HL        23
16610 LD(HL)58      36 3A
16612 INC HL        23
16613 LD(HL)57      36 39
16515 INC HL        23
16516 LD(HL)0       36 00
16618 INC HL        23
16619 LD(HL)52      36 34
16621 INC HL        23
16622 LD(HL)43      36 2B
16524 INC HL        23
16525 LD(HL)0       36 00
16527 INC HL        23
16528 LD(HL)41      36 29
16530 INC HL        23
16631 LD(HL)38      36 26
16633 INC HL        23
16634 LD(HL)57      36 39
16636 INC HL        23
16637 LD(HL:38      36 26
16639 RET           C9
```




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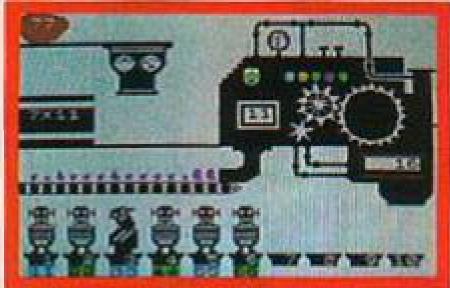
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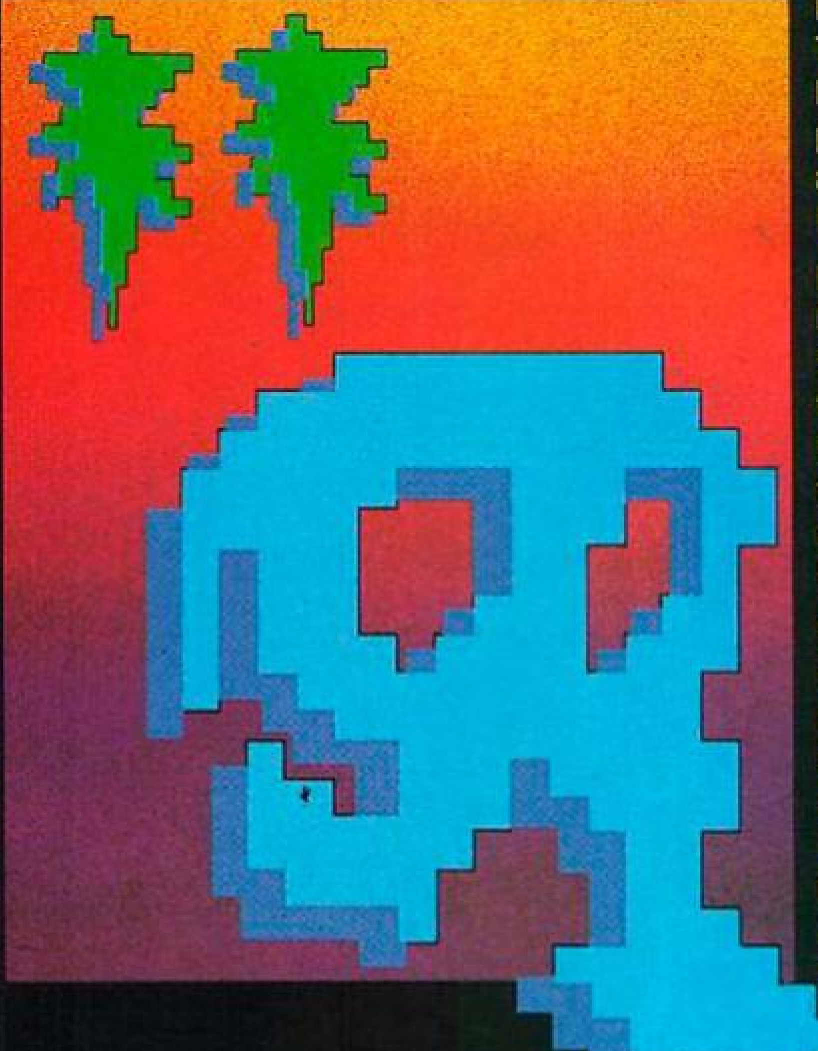
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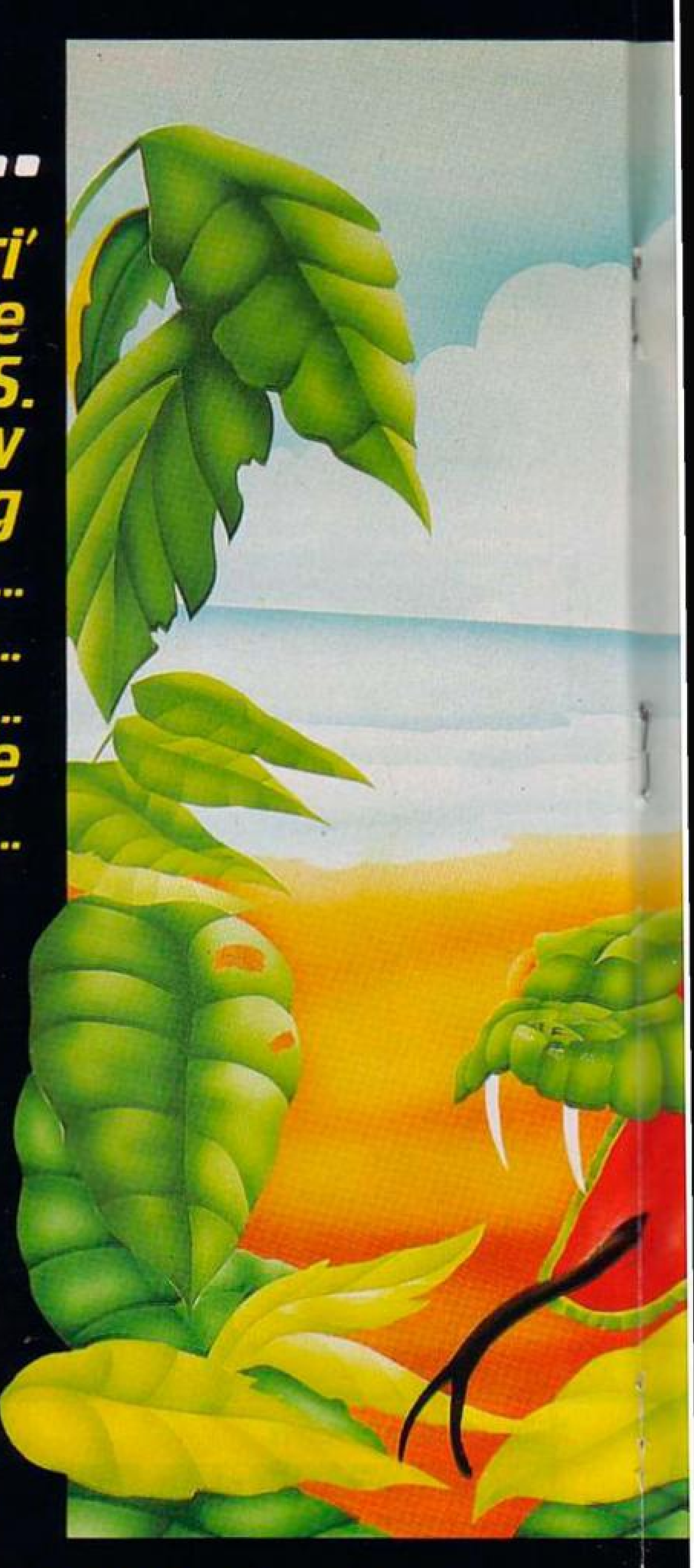
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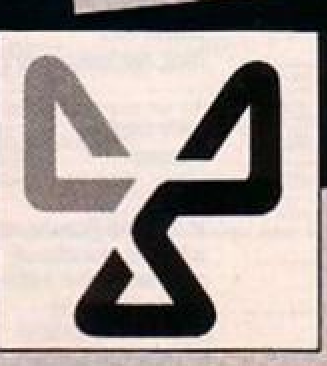
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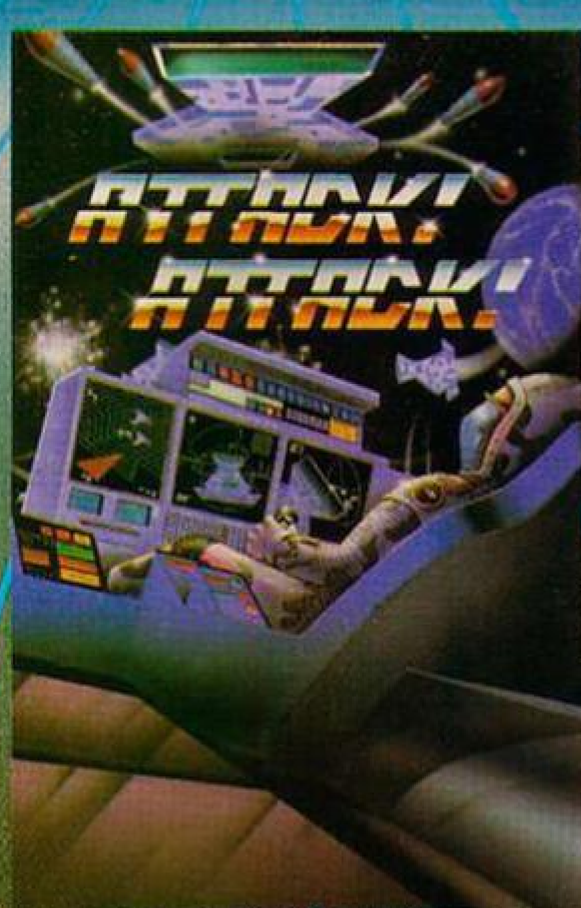
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The Marcon [illegible] enslaved the [illegible]. An endless stream of stellafreighters [illegible] plunder the earth's mineral wealth, [illegible] the very lifeblood of the planet.
A small band of freedom fighters are still operating from an abandoned mining station on the Moon, one of them is you.
As you set out from your secret base your first objective is to manoeuvre through the barrage of lethal space mines to one of the enemy re-charging stations to recharge your [illegible] lasers then you will be able to carry on with your mission of destroying the [illegible] stellafreighters.
There is rumour of a Marcon munition station near by, heavily defended by missiles. If only you could locate and plunder it: your heroic band of avengers would then have enough fire power to strike a massive blow for freedom . . . or die in the attempt . . .
Avenger is for the Dragon 32.



Available soon

Tension mounts as your [illegible] enters the patrol area. Enemy Sky[illegible] Convoys are increasing as their need [illegible] in the arms race against you.
Your raydon missile sight picks up an enemy convoy entering your quadrant. You select hyperdrive and are slammed back in your seat. Fingers hover over firing buttons as enemy fighters peel away from the convoy to engage you. As your epic battle begins the enemy Skyfreighters unleash wave after wave of air to air missiles against you. The battle rages on and your will to survive and determination to win increases. The convoy must be destroyed: your people are depending on you.
Night falls and glaring explosions fill the sky: don't let your concentration wander, if the convoy gets through your people are doomed, you must succeed, you must . . .
Attack Attack is for the Commodore 64.



Your mission: destroy the [illegible] rocket base on the planet Hagon.
[illegible] space fighter yet [illegible] you know that if your mission fails the awesome [illegible] will destroy your galaxy.
[illegible]
The Hagon fleet have been alerted and wave after wave of Astrofighters come hurtling toward you. As you battle your way to the end of the tunnel you begin to realise just how [illegible] this mission could be.
Zooming through Hagon's defensive asteroid belt your concentration intensifies: you have only a fraction of a second to differentiate between asteroids, space mines and [illegible] rockets as they flash toward you.
Hugging the planet's surface, dodging defence poles and trying to deal with everything else the Hagon's throw at you, you remind yourself that the fate of an entire galaxy rests on the outcome of your mission, you must succeed . . . Quasar is for the Commodore 64.

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Quasar	☐
Attack Attack	☐

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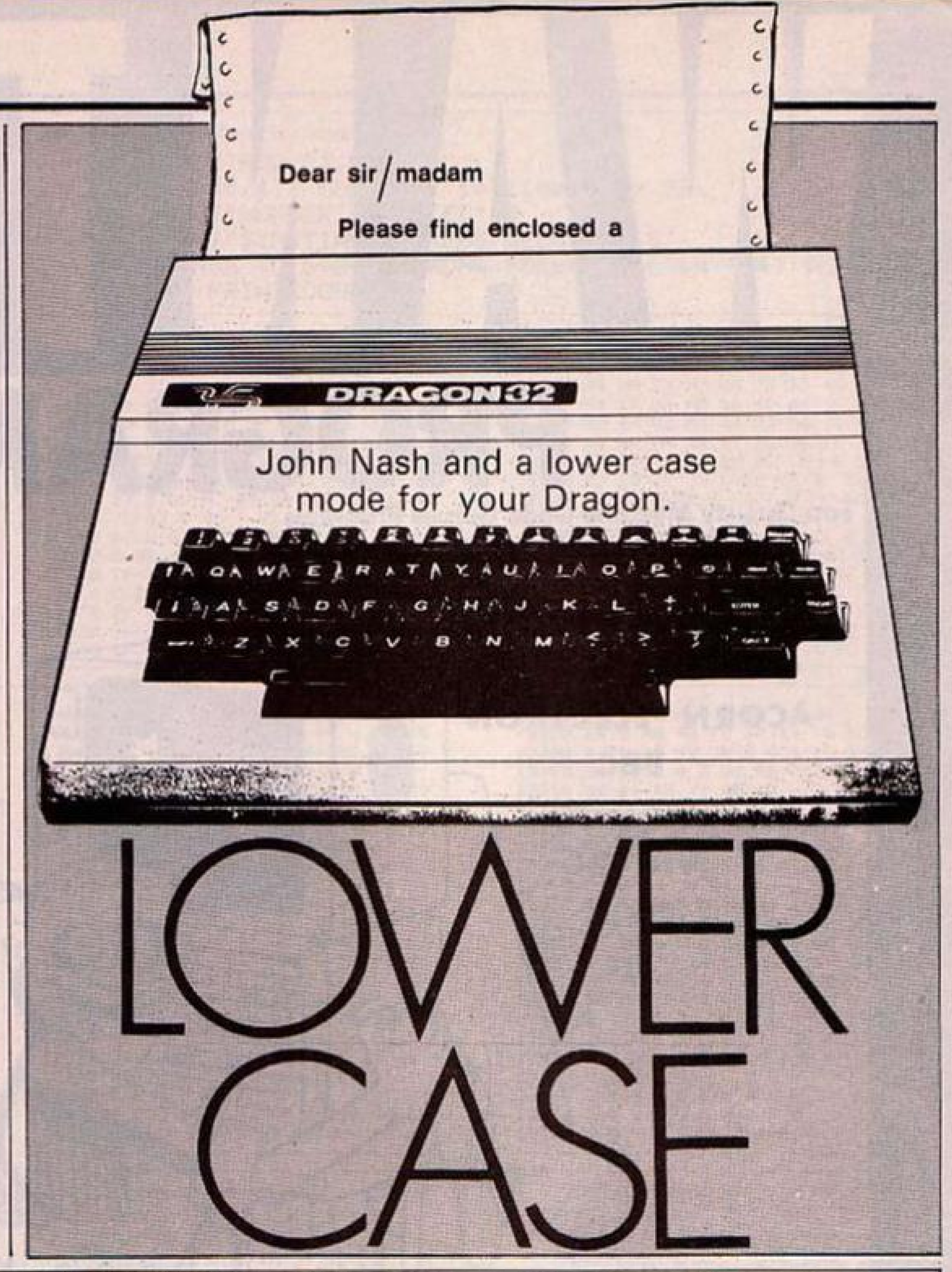
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Voyager Software, Business Centre, Claughton Road, Birkenhead, Merseyside, L41 6ES. Telephone: 051-647 8616.



LOWER CASE

John Nash and a lower case mode for your Dragon.

THE DRAGON 32 does not have lower case text built into ROM, and allows only 512 characters on the text screen. This can be a little restrictive, and the inverse display of characters that will be printed as lower case is not ideal.

This routine takes characters which have been stored in the RAM addresses 13500 onwards, looks up a character table giving the bit configuration of each character, and Pokes it onto the high-resolution screen. This is primarily intended as an extension to the word processor program, but could be used by any text-handling or file-storing routine.

The program recognises the left and right square brackets as indications for a new line and paragraph repectively — CHR$(91) and (93) — The format chosen is limited by the number of pixels available: 256 wide by 192 high in PMode4. It is difficult to devise a legible character set with fewer than 5 by 7 dots per character, and allowing a blank line of pixels between each character and each line, this gives 6 by 8 dot format. This allows 42 characters per line, and 24 lines per screen, up to 1,008 characters in all.

The program requires the starting address of the stored text to be Poked into addresses 12818 and 12819 before running, and returns the address reached during that screen display in addresses 12816 and 12817. To call the lower case routine, use Exec 12500.

Note that the word processor has to be moved upwards in memory to allow the new routine access to the high-resolution screens. A revised Basic listing as well as reassembled machine code is provided. The lower case display is called by pressing E and N displays the next screenful, while R returns to the main program. The word processor has another new feature: L will now allow a search for a character string of length 1 to 8, and will

(continued on page 145)

Assembly listing for lower case program.

```
30D4                        ORG   12500
          320A      FLAG    EQU   12810
          320B      TIMCTR  EQU   12811
          320C      COLCTR  EQU   12812
          3212      STORE   EQU   12818
          3134      TSTART  EQU   12596
          320D      ROWCTR  EQU   12813
          320E      LINADR  EQU   12814
          0600      BEGSCR  EQU   1536
          1DFF      ENDSCR  EQU   7679
          3210      TEXEND  EQU   12816
30D4 BD   31A5              JSR   CLEARS
30D7 8E   0600      INIT    LDX   #BEGSCR
30DA BF   320E              STX   LINADR
30DD 7F   320C              CLR   COLCTR
30E0 7F   320B              CLR   TIMCTR
30E3 108E 3212              LDY   STORE
30E7 E6   A0        LOOP2   LDB   ,Y+
30E9 C1   5B                CMPB  #91
30EB 1027 00C3              LBEQ  NL
30EF C1   5D                CMPB  #93
30F1 1027 00F3              LBEQ  PARA
30F5 86   07                LDA   #7
30F7 3D                     MUL
30F8 C3   3134              ADDD  #TSTART
30FB 1F   03                TFR   D,U
30FD 7F   320D              CLR   ROWCTR
3100 A6   C4        LOOP1   LDA   ,U
3102 F6   320B              LDB   TIMCTR
3105 C1   01                CMPB  #1
3107 27   66                BEQ   SECOND
3109 C1   02                CMPB  #2
310B 27   78                BEQ   THIRD
310D C1   03                CMPB  #3
310F 1027 0089              LBEQ  FOURTH
3113 A7   84                STA   ,X
3115 30   88 20     BACK    LEAX  32,X
3118 33   41                LEAU  1,U
311A 7C   320D              INC   ROWCTR
311D 86   07                LDA   #7
311F B1   320D              CMPA  ROWCTR
3122 26   DC                BNE   LOOP1
3124 86   00                LDA   #0
3126 A7   84                STA   ,X
3128 30   89 FF21           LEAX  -223,X
312C 7C   320B              INC   TIMCTR
312F 86   04                LDA   #4
3131 B1   320B              CMPA  TIMCTR
3134 26   05                BNE   GOON
3136 30   1F                LEAX  -1,X
3138 7F   320B              CLR   TIMCTR
313B 7C   320C      GOON    INC   COLCTR
313E 86   2A                LDA   #42
3140 B1   320C              CMPA  COLCTR
3143 26   0A                BNE   GOON2
3145 30   89 00E0           LEAX  224,X
3149 7F   320B              CLR   TIMCTR
314C BF   320E              STX   LINADR
314F 86   54        GOON2   LDA   #84
3151 B1   320C              CMPA  COLCTR
3154 26   0D                BNE   CARRON
3156 7F   320C              CLR   COLCTR
3159 7F   320B              CLR   TIMCTR
315C 30   89 00E0           LEAX  224,X
3160 BF   320E              STX   LINADR
3163 8C   1D21      CARRON  CMPX  #7457
3166 1025 FF7D              LBLO  LOOP2
316A 10BF 3210              STY   TEXEND
316E 39                     RTS
316F 48             SECOND  LSLA
3170 48                     LSLA
3171 1F   89                TFR   A,B
3173 A6   C4                LDA   ,U
3175 44                     LSRA
3176 44                     LSRA
3177 44                     LSRA
3178 44                     LSRA
3179 44                     LSRA
317A 44                     LSRA
317B EA   84                ORB   ,X
317D E7   84                STB   ,X
317F AA   82                ORA   ,-X
3181 A7   80                STA   ,X+
3183 20   90                BRA   BACK
3185 44             THIRD   LSRA
3186 44                     LSRA
3187 44                     LSRA
3188 44                     LSRA
3189 1F   89                TFR   A,B
318B A6   C4                LDA   ,U
318D 48                     LSLA
318E 48                     LSLA
318F 48                     LSLA
3190 48                     LSLA
3191 EA   82                ORB   ,-X
3193 E7   80                STB   ,X+
3195 AA   84                ORA   ,X
3197 A7   84                STA   ,X
3199 16   FF79              LBRA  BACK
319C 44             FOURTH  LSRA
319D 44                     LSRA
319E AA   82                ORA   ,-X
31A0 A7   80                STA   ,X+
31A2 16   FF70              LBRA  BACK



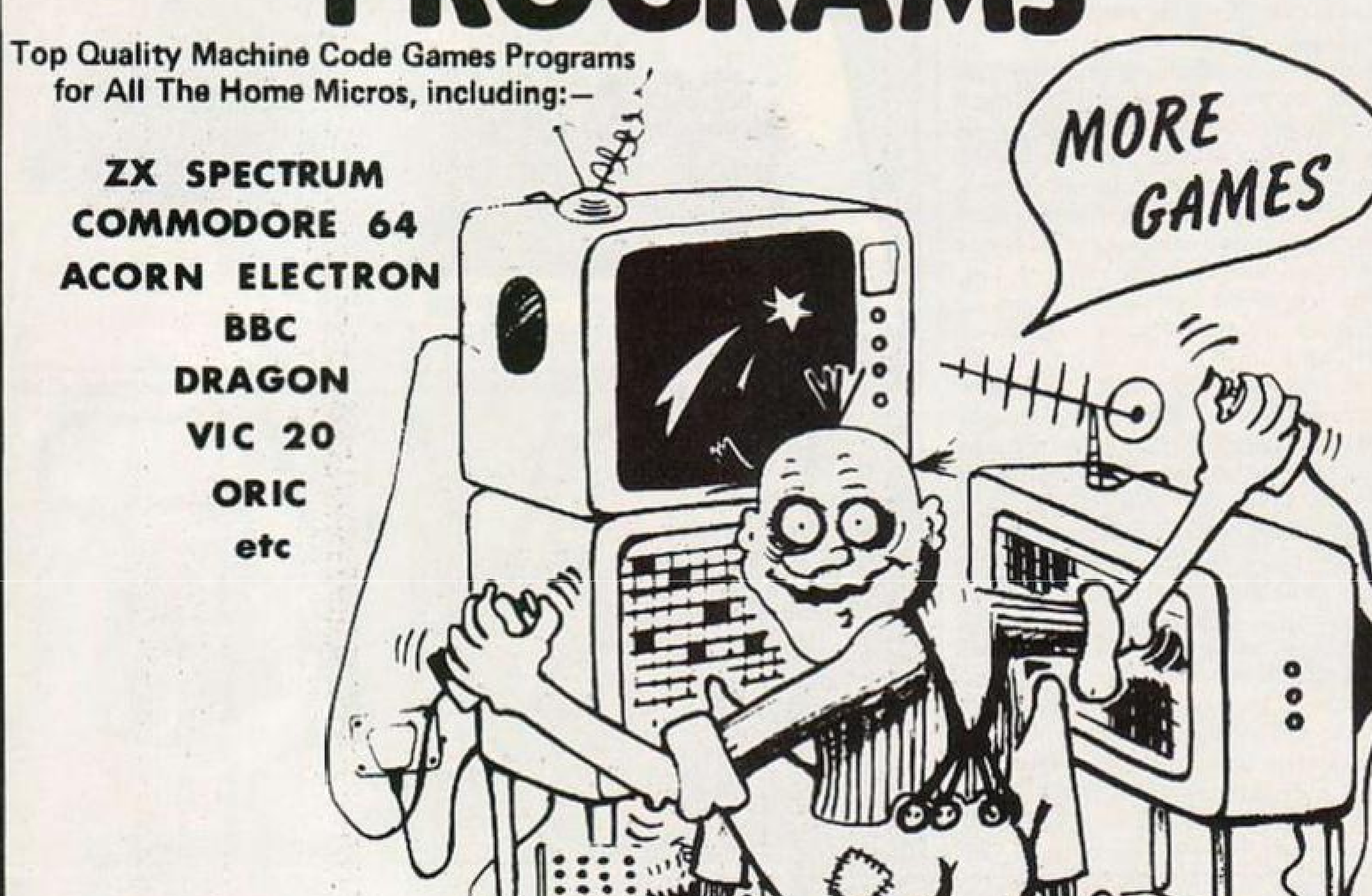
31A5 8E   0600      CLEARS  LDX   #BEGSCR
31A8 86   00                LDA   #0
31AA A7   80        LOOP3   STA   ,X+
31AC 8C   1DFF              CMPX  #ENDSCR
31AF 25   F9                BLO   LOOP3
31B1 39                     RTS
31B2 7C   320C      NL      INC   COLCTR
31B5 86   2A                LDA   #42
31B7 B1   320C              CMPA  COLCTR
31BA 26   09                BNE   GOON3
31BC FC   320E              LDD   LINADR
31BF C3   0100              ADDD  #256
31C2 FD   320E              STD   LINADR
31C5 86   54        GOON3   LDA   #84
31C7 B1   320C              CMPA  COLCTR
31CA 26   E6                BNE   NL
31CC 7F   320C              CLR   COLCTR
31CF 7F   320B              CLR   TIMCTR
31D2 FC   320E              LDD   LINADR
31D5 C3   0100              ADDD  #256
31D8 FD   320E              STD   LINADR
31DB 1F   01                TFR   D,X
31DD 86   01                LDA   #1
31DF B1   320A              CMPA  FLAG
31E2 1026 FF7D              LBNE  CARRON
31E6 20   07                BRA   CONTPA
31E8 86   01        PARA    LDA   #1
31EA B7   320A              STA   FLAG
31ED 20   C3                BRA   NL
31EF 7F   320A      CONTPA  CLR   FLAG
31F2 7C   320C      CONTP2  INC   COLCTR
31F5 7C   320C              INC   COLCTR
31F8 7C   320C              INC   COLCTR
31FB 7C   320C              INC   COLCTR
31FE 30   03                LEAX  3,X
3200 16   FF60              LBRA  CARRON
          0000              END
00000 TOTAL ERRORS

BACK     3115
BEGSCR   0600
CARRON   3163
CLEARS   31A5
COLCTR   320C
CONTP2   31F2
CONTPA   31EF
ENDSCR   1DFF
FLAG     320A
FOURTH   319C
GOON     313B
GOON2    314F
GOON3    31C5
INIT     30D7
LINADR   320E
LOOP1    3100
LOOP2    30E7
LOOP3    31AA
NL       31B2
PARA     31E8
ROWCTR   320D
SECOND   316F
STORE    3212
TEXEND   3210
THIRD    3185
TIMCTR   320B
TSTART   3134
```

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HUGE

REWARD

(continued from page 143)

highlight every occurrence of it in the text — N for next occurrence, R to return to main program.

To load the new word processor, first switch off then on to reset the machine. Then Clear 192,12000. Then CloadM followed by Cload to load the machine code and Basic from tape. Lastly, Run for new text, or Goto 100 for existing text.

Finally, you may like to devise your own character set. This is stored at 12820 to 13491, and each character has seven successive bytes. The eight byte is put in by the routine as it is always a zero. To find a character, multiply its ASCII code by seven and add to 12596. For example, ! is code 33 and so starts at 12596+33*7=12827. You must put in zeros or similar packing characters for the codes not available from the keyboard, e.g. codes 123 127. ■

Hex loader. Erase when data stored.

```
10 REM DATABD,31,A5 etc.
20 REM Put all the data in lines 1 - 99
100 INPUT"NUMBER OF BYTES";B
110 INPUT"STARTING ADDRESS DECIMAL";S
120 FORN=S TO S+B-1:READA$:POKEN,VAL("&H"+A$):NEXT
130 CLS:PRINT"DONE"
```

Lower case text.

```
12500 BD 31 A5 8E 6 0 BF 32 E 7F
12510 32 C 7F 32 B 10 BE 32 12 E6
12520 A0 C1 5B 10 27 0 C3 C1 5D 10
12530 27 0 F3 86 7 3D C3 31 34 1F
12540 3 7F 32 D A6 C4 F6 32 B C1
12550 1 27 66 C1 2 27 78 C1 3 10
12560 27 0 89 A7 84 30 88 20 33 41
12570 7C 32 D 86 7 B1 32 D 26 DC
12580 86 0 A7 84 30 89 FF 21 7C 32
12590 B 86 4 B1 32 B 26 5 30 1F
12600 7F 32 B 7C 32 C 86 2A B1 32
12610 C 26 A 30 89 0 E0 7F 32 B
12620 BF 32 E 86 54 B1 32 C 26 D
12630 7F 32 C 7F 32 B 30 89 0 E0
12640 BF 32 E 8C 1D 21 10 25 FF 7D
12650 10 BF 32 10 39 48 48 1F 89 A6
12660 C4 44 44 44 44 44 44 EA 84 E7
12670 84 AA 82 A7 80 20 90 44 44 44
12680 44 1F 89 A6 C4 48 48 48 48 EA
12690 82 E7 80 AA 84 A7 84 16 FF 79
12700 44 44 AA 82 A7 80 16 FF 70 8E
12710 6 0 86 0 A7 80 8C 1D FF 25
12720 F9 39 7C 32 C 86 2A B1 32 C
12730 26 9 FC 32 E C3 1 0 FD 32
12740 E 86 54 B1 32 C 26 E6 7F 32
12750 C 7F 32 B FC 32 E C3 1 0
12760 FD 32 E 1F 1 86 1 B1 32 A
12770 10 26 FF 7D 20 7 86 1 B7 32
12780 A 20 C3 7F 32 A 7C 32 C 7C
12790 32 C 7C 32 C 7C 32 C 30 3
12800 16 FF 60 E 12 12 2 2 2 2
12810 2 0 0 7 1E 0 38 AC 34 BC
```

Character set.

```
12820 0 0 0 0 0 0 0 10 10 10
12830 10 0 10 0 28 28 28 0 0 0
12840 0 28 28 7C 28 7C 28 28 38 54
12850 50 38 14 54 38 64 68 10 10 10
12860 2C 4C 38 44 48 30 34 48 34 10
12870 10 10 0 0 0 0 20 40 40 40
12880 40 40 20 8 4 4 4 4 4 8
12890 10 10 7C 10 28 44 0 0 10 10
12900 7C 10 10 0 0 0 0 30 10 20
12910 0 0 0 0 7C 0 0 0 0 0
12920 0 18 18 0 0 4 4 8 10 20
12930 40 40 38 4C 54 54 64 38 0 10
12940 30 10 10 10 38 0 38 44 4 8
12950 30 4C 0 78 4 38 4 44 3C 0
12960 8 18 28 48 7C 8 0 7C 40 38
12970 4 4 78 0 1C 20 78 44 44 38
12980 0 7C 4 8 10 20 40 0 38 44
12990 38 44 44 38 0 38 44 44 3C 4
13000 38 0 0 0 10 0 10 0 0 0
13010 0 10 0 10-10 0-8 10 20 40
13020 40 20 18 0 0 0 7C 0 7C 0
13030 20 10 8 4 4 8 10 38 44 44
13040 8 10 0 10 7C 44 44 5C 5C 40
13050 7C 10 28 44 7C 44 44 0 78 44
13060 78 44 44 78 0 38 44 40 40 44
13070 38 0 78 44 44 44 44 78 0 7C
13080 40 78 40 40 7C 0 7C 40 78 40
13090 40 40 0 38 44 40 5C 48 38 0
13100 44 44 7C 44 44 44 0 7C 10 10
13110 10 10 7C 0 7C 10 10 50 30 10
13120 0 44 48 50 70 48 44 0 40 40
13130 40 40 40 7C 0 44 6C 54 44 44
13140 44 0 44 64 54 54 4C 44 0 38
13150 44 44 44 44 38 0 78 44 44 78
13160 40 40 0 38 44 44 54 4C 38 0
13170 78 44 44 78 48 44 0 38 44 30
13180 C 44 38 0 7C 10 10 10 10 10
13190 0 44 44 44 44 44 38 0 44 44
13200 44 44 28 10 0 44 44 44 54 6C
13210 44 0 44 28 10 28 44 44 0 44
13220 28 10 10 10 10 0 7C 8 10 20
13230 40 7C 0 0 0 0 0 0 0 0
13240 0 0 0 0 0 0 0 0 0 0
13250 0 0 0 0 10 38 54 10 10 10
13260 0 0 10 20 7C 20 10 0 0 0
13270 0 0 0 0 0 0 0 38 4C 54
13280 24 0 40 40 78 44 44 78 0 0
13290 0 38 40 40 38 0 4 4 1C 24
13300 24 1C 0 0 0 38 48 70 78 0
13310 38 44 40 70 40 40 0 0 0 38
13320 44 3C 4 38 40 40 78 44 44 44
13330 0 10 0 30 10 10 38 0 8 0
13340 8 8 8 48 30 40 40 78 44 78
13350 44 0 40 40 40 40 50 20 0 0
13360 0 68 54 54 54 0 0 0 58 64
13370 44 44 0 0 0 38 44 44 38 0
13380 0 0 78 44 78 40 40 0 0 38
13390 44 38 8 C 0 0 58 64 40 40
13400 0 0 0 18 24 54 48 0 40 40
13410 78 40 40 38 0 0 0 44 44 44
13420 38 0 0 0 44 44 28 10 0 0
13430 0 44 44 54 28 0 0 0 6C 10
13440 28 44 0 0 0 44 44 3C 4 38
13450 0 0 3C 8 10 3C 0 0 0 0
13460 0 0 0 0 0 0 0 0 0 0
13470 0 0 0 0 0 0 0 0 0 0
13480 0 0 0 0 0 0 0 0 0 0
13490 0 0 FF FF EF EF FF FF FF FF
```

Revised machine code for word processor.

```
12000 8E 4 0 10 BE 30 C8 CE 2 0
12010 A6 A0 81 20 27 2D 81 21 27 29
12020 81 27 27 25 81 2C 27 21 81 2E
12030 27 1D 81 3A 27 19 81 3B 27 15
12040 81 3F 27 11 81 61 24 11 A7 80
12050 33 5F 11 83 0 0 27 2 20 CE
12060 39 8B 40 20 EF 80 60 20 EB FE
12070 30 C4 BE 30 C2 A6 80 81 5D 27
12080 26 81 5B 27 1E 81 5E 27 12 81
12090 5F 27 12 BD 80 F 33 5F 11 83
12100 0 0 27 2 20 E1 39 86 E 20
12110 EE 86 F 20 EA 86 A 20 E6 86
12120 A BD 80 F 86 20 BD 80 F 86
12130 20 BD 80 F 86 20 BD 80 F 86
12140 20 BD 80 F 86 20 20 C9 FE 30
12150 D2 BE 30 CC FC 30 CC F3 30 D2
12160 FD 30 CC 30 1 10 BE 30 C6 A6
12170 A0 A7 80 33 5F 11 83 0 0 27
12180 2 20 F2 39 FC 30 CC 83 30 CA
12190 1F 3 33 41 BE 30 CC FC 30 CE
12200 C3 0 1 FD 30 CC 10 BE 30 CC
12210 30 1 31 21 A6 82 A7 A2 33 5F
12220 11 83 0 0 27 2 20 F2 FC 30
12230 D2 83 0 1 FD 30 D2 CC 0 0
12240 10 B3 30 D2 27 2 20 C0 39 FC
12250 30 CA C3 0 1 FD 30 CA FC 30
12260 CC 83 30 CA 1F 3 33 42 FC 30
12270 CC 83 0 1 FD 30 CC BE 30 CA
12280 FC 30 CA 83 0 1 FD 30 CA 10
12290 BE 30 CA A6 80 A7 A0 33 5F 11
12300 83 0 0 27 2 20 F2 FC 30 D2
12310 83 0 1 FD 30 D2 CC 0 0 10
12320 B3 30 D2 27 2 20 B8 39 FE 30
12330 D2 BE 30 D0 10 BE 30 CE A6 80
12340 A7 A0 33 5F 11 83 0 0 27 2
12350 20 F2 39 FE 30 D2 BE 30 CA 10
12360 BE 30 C6 A6 A0 A7 80 33 5F 11
12370 83 0 0 27 2 20 F2 39 8E 34
12380 BC 86 20 A7 80 8C 7F FE 24 2
12390 20 F7 39 CE 0 65 10 8E 30 B8
12400 E6 A0 F7 30 B4 BE 30 B0 C6 0
12410 A6 80 B1 30 B4 27 7 8C 30 AE
12420 27 1E 20 F0 36 30 A6 A0 B7 30
12430 B2 5C F1 30 B6 27 D A6 80 B1
12440 30 B2 27 EE 20 0 37 30 20 D6
12450 37 30 BF 30 B0 39 DF DF DF DF
12460 5F DF DF DF F7 DF DF DF DF DF
12470 F7 FF DF DF FF FF FF FF FF FF
12480 10 0 0 0 10 0 2E C0 34 BC
12490 0 0 34 D0 0 0 0 0 0 1D
```

Word processor instructions.

1. Switch off then on.
2. CLEAR 192,12000.
3. CLOADM.
4. CLOAD.
5. RUN (or GOTO 100 for old text).

New Basic for word processor.

```
10 POKE12492,32:POKE12493,107
20 GOSUB2000
100 Q$=INKEY$:IFQ$<>""THENCLS
105 IFQ$="S"ORQ$="s"THENGOSUB1600
110 IFQ$="I"ORQ$="i"THENGOSUB1400
120 IFQ$="D"ORQ$="d"THENGOSUB1200
130 IFQ$="T"ORQ$="t"THENGOSUB1000
140 IFQ$="P"ORQ$="p"THENGOSUB600
150 IFQ$="C"ORQ$="c"THENGOSUB200
160 IFQ$="O"ORQ$="o"THENGOSUB800
170 IFQ$="M"ORQ$="m"THENGOSUB1800
180 IFQ$="H"ORQ$="h"THENGOSUB2000
190 IFQ$="W"ORQ$="w"THENGOSUB2200
191 IFQ$="E"ORQ$="e"THENGOSUB3200
195 IFQ$="Z"ORQ$="z"THENGOSUB2600
196 IFQ$="L"ORQ$="l"THENGOSUB2800
197 IFPEEK(12492)>126 THEN CLS:PRINT"FULL":STOP
199 GOTO100
200 INPUT"CERTAIN (Y)";A$
210 IF A$="Y" THEN EXEC12370
220 RETURN
400 H=JOYSTK(0):V=JOYSTK(1)
410 H=H/2:V=INT(V/4)
420 CU=(1024+32*V+H):POKECU,159
430 CR=13500+(SC-1)*512+CU-1024
440 POKE12490,INT(CR/256):POKE12491,CR-(PEEK(12490)*256)
445 GOSUB1610
447 LI=256*PEEK(12492)+PEEK(12493)
450 Q$=INKEY$:IFQ$="R"ORQ$="r"THENRETURNELSE400
600 INPUT"START PRINTING AT BEGINNING OF SCREEN NO. ";N
605 N=13500+512*(N-1)
610 POKE12482,INT(N/256):POKE12483,N-(PEEK(12482)*256)
620 INPUT"NUMBER OF SCREENS I SHOULD PRINT ";N
630 POKE12484,N*2:POKE12485,0
640 EXEC12059
650 RETURN
800 FR=1:PRINT"OVERWRITE":GOSUB1000
810 GOSUB1600:GOSUB400:IF CR>=LI THENGOSUB2400:RETURN
820 EXEC12353
830 FR=0:A$="":RETURN
1000 LINE INPUT "TEXT ";A$
1005 IF A$="" THEN 1000
1010 L=LEN(A$):IF L>160 THEN PRINT:PRINT
     "TOO LONG":RETURN
1020 A=VARPTR(A$)+2:B=VARPTR(A$)+3
1030 POKE12486,PEEK(A):POKE12487,PEEK(B):
     POKE12498,0:POKE12499,L
1035 IF FR=1 THEN RETURN
1040 EXEC12140
1050 A$="":RETURN
1200 INPUT"NUMBER TO DELETE";N:IFN=0 THEN N=1
1205 GOSUB1600
1210 POKE12498,INT(N/256):POKE12499,N-(PEEK(12498)*256)
1220 GOSUB400
1225 IF CR>=LI THEN GOSUB2400:RETURN
1226 IF N>=(CR-13500) THEN GOSUB2400:RETURN
1230 EXEC12249
1240 RETURN
1400 FR=1:PRINT"INSERT":GOSUB1000
1410 GOSUB1600:GOSUB400:IF LI<=CR THEN GOSUB2400:RETURN
1420 EXEC12184
1430 POKE12498,0:POKE12499,L:EXEC12153
1440 FR=0:A$="":RETURN
1600 INPUT"SCREEN ";SC:IFSC=0 THEN SC=1
1605 IFSC>37THENSC=37
1610 SP=13500+(SC-1)*512:POKE12488,INT(SP/256):
     POKE12489,SP-(PEEK(12488)*256)
1620 EXEC12000
1650 RETURN
1800 INPUT"MOVE HOW MANY";N
1810 POKE12498,INT(N/256):POKE12499,N-(PEEK(12498)*256)
1820 PRINT"SET CURSOR FOR SOURCE":GOSUB1600:GOSUB400
1830 POKE12496,PEEK(12490):POKE12497,PEEK(12491):LI
1840 PRINT"SET CURSOR FOR DESTINATION":GOSUB1600:GOSUB400
1850 POKE12494,PEEK(12490):POKE12495,PEEK(12491)
1860 EXEC12328
1870 RETURN
2000 CLS
2010 PRINT"C TO CLEAR MEMORY":PRINT"T TO LOAD TEXT":
     PRINT"P TO PRINT OUT":PRINT" S TO DISPLAY":PRINT"W FOR
     CURRENT SCREEN":PRINT"I TO INSERT":PRINT"D TO DELETE":
     PRINT"M TO MOVE BLOCK":PRINT"O TO OVERWRITE":
     PRINT"H FOR HELP":PRINT"Z FOR CHAR"
2015 PRINT"L TO SEARCH",,"E TO PACK TEXT"
2020 PRINT:PRINT"R TO RETURN FROM CURSOR"
2030 RETURN
2200 IF SC=0 THEN SC=1
2210 GOSUB1610
2220 RETURN
2400 CLS:PRINT"YOU CAN'T":RETURN
2600 INPUT"CODE ";C:A$=CHR$(C)
2610 FR=1:GOSUB1010:FR=0
2620 GOSUB810:A$="":RETURN
2800 PRINT"N FOR NEXT, R TO RETURN"
2810 A$="":INPUT"SEARCH FOR ";A$
2820 IFLEN(A$)>8 OR A$="" THEN 2810
2830 POKE12478,LEN(A$)
2835 FORN=1 TO LEN(A$):C=ASC(MID$(A$,N)):POKE(12471+N),C:NEXT
2840 INPUT"SCREEN ";PA:PA=PA-1
2850 T4=13500+PA*512:EP=T4+520
2860 POKE12464,(T4/256):POKE12465,(T4-PEEK(12464)*256)
2870 POKE12462,(EP/256):POKE12463,(EP-PEEK(12462)*256)
2880 EXEC12393
2882 T4=256*PEEK(12464)+PEEK(12465)
2884 IFT4>32767THENCLS:PRINT"DONE":RETURN
2885 IFT4>=EP THENGOTO3000
2890 SC=PA+1:GOSUB1610
2900 CP=T4-12477-PA*512:POKECP,159
2910 Q$=INKEY$:IFQ$="N"ORQ$="n"THEN T4=T4+1:GOTO2860
2920 IFQ$="R"ORQ$="r"THEN CLS:PRINT"?":RETURN
2930 Q$="":GOTO2890
3000 CLS:PA=PA+1:PRINT"SCREEN ";PA+1
3010 FORD=1TO500:NEXT
3020 GOTO2850
3200 PRINT"N FOR NEXT",,"R TO RETURN"
3210 POKE12818,52:POKE12819,180
3220 PMODE4:SCREEN1,1
3230 EXEC12500
3240 Q$=INKEY$:IFQ$="R"ORQ$="r"THENCLS:PRINT"AND NEXT"
     SCREEN0:RETURN
3250 IFQ$="N"ORQ$="n"THENPOKE12818,PEEK(12916):
     POKE12819,PEEK(12917):IFPEEK(12818)*256+PEEK(12819)
     8))127 THENSCREEN0:CLS:PRINT"THAT'S ALL":RETURNELSE3230
3260 GOTO3240
```

There are two commands on your Spectrum which are for the Microdrive alone. Richard Taylor says "So what?"



Program 1.

```
10 LET a=PEEK 23631+256*PEEK 23632
20 IF PEEK a=128 THEN STOP
30 PRINT "CHANNEL ";CHR$ (PEEK (a+4))
40 PRINT "Output address=";PEEK a+256*PEEK (a+1)
50 PRINT "Input address =";PEEK (a+2)+256*PEEK (a+3)
60 PRINT : LET a=a+5: GO TO 20
```

Listing 1.

23760	-	30	93	198	21
23764	-	0	124	75	204
23768	-	204	204	125	75
23772	-	204	204	204	126
23776	-	76	204	204	204
23780	-	126	127	255	255
23784	-	255	127	25	153
23788	-	153	153	127	127
23792	-	255	255	255	128
23796	-	64	0	0	0
23800	-	0	0	1	0
23804	-	0	129	64	0
23808	-	0	0	0	0
23812	-	2	0	0	45
23816	-	55	0	10	20
23820	-	25	35	50	55
23824	-	5	15	20	30
23828	-	40	175	50	212
23832	-	92	33	233	92
23836	-	34	176	92	33
23840	-	27	0	34	30
23844	-	92	201	217	197
23848	-	213	229	217	205
23852	-	52	93	217	225
23856	-	209	193	217	201
23860	-	254	33	216	40
23864	-	74	254	42	40
23868	-	70	254	35	40
23872	-	61	205	141	44
23876	-	208	203	239	254
23880	-	104	208	214	97
23884	-	33	7	93	253
23888	-	203	119	126	40
23892	-	3	33	14	93
23896	-	6	0	79	9
23900	-	78	33	110	4
23904	-	9	253	203	119
23908	-	190	205	180	51
23912	-	239	56	56	212
23916	-	92	134	119	239
23920	-	192	2	56	42
23924	-	176	92	203	188
23928	-	205	180	51	195
23932	-	74	4	253	203
23936	-	119	254	201	50
23940	-	14	92	17	140
23944	-	93	195	128	10
23948	-	17	30	93	205
23952	-	128	10	205	27
23956	-	45	216	79	55
23960	-	14	92	254	33
23964	-	40	13	121	214
23968	-	48	33	213	92
23972	-	205	6	52	34
23976	-	176	92	201	62
23980	-	203	129	50	212
23984	-	92	201		

Listing 2.

```
   1 REM 000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000
  10 LET a=0
  20 FOR b=23760 TO 23985
  30 INPUT c: POKE 23692,-1
  40 LET a=a+c: POKE b,c
  50 PRINT b,PEEK b
  60 NEXT b
  70 IF a<>24978 THEN PRINT "ERROR": BEEP 1,-25
```

Listing 3.

```
1000 FOR a=23760 TO 23985
1010 POKE 23692,-1: PRINT a;" = ";PEEK a
1020 IF INKEY$="" THEN GO TO 1020
1030 NEXT a
```

Listing 4.

```
2000 CLEAR : LET a=0
2010 INPUT "Which duration number? ";b
2020 IF b<0 OR b>9 OR b<>INT b THEN GO TO 2010
2030 LET b=23765+b*5
2040 INPUT "Length of duration in secs? ";a
2050 IF a<0 OR a>10 THEN GO TO 2040
2060 LET c=1+(PEEK 23627+256*PEEK 23628)
2070 FOR d=0 TO 4: POKE b+d,PEEK (c+d): NEXT d
```

Listing 5

```
  10 RANDOMIZE USR 23829
  20 LET a$="!"+4C0+3O0+4B0+3O0+5G0!6+3D0+4C!5G+2A+4A0!6+3CC!5+4BA+3B0+4G0+3A0+4F0A+3C"
  30 PRINT #4;a$;a$: GO TO 30
```

Listing 6.

```
  10 LET b=PEEK 23631+256*PEEK 23632
  20 FOR a=23574 TO 23605 STEP 2
  30 PRINT "Stream ";(a-23574)/2,TAB 9;"=";
  40 IF PEEK a+256*PEEK (a+1)=0 THEN PRINT "CLOSED": NEXT a: STOP
  50 LET c=(PEEK a+256*PEEK (a+1))+b+3
  60 PRINT "POINTS TO CHANNEL ";CHR$ PEEK c: NEXT a
```



OPENING, CLOSING

A SUBJECT COMPLETELY neglected in the Sinclair ZX Spectrum programming manual is the operation of the Open# and Close# commands. Sinclair claims that these commands are designed for use with its Microdrive. Much of their power, however, can be realised without a Microdrive. To illustrate this untapped power I include, as an example, a routine which will emulate the Play command found, in one form or another on the majority of computers with sound generators. It saves you the time consuming job of converting music into the complicated decimal numbers required by Sinclair's rather feeble Beep command.

The way in which your Spectrum communicates with the devices in the outside world, namely the screen, keyboard and printer, is complicated but extremely powerful. From page 165 of the Basic manual you will find a memory allotment called the channel information area, sandwiched between the system variables and the Basic program area in the memory map.

This area holds information about the input/output devices connected to the system. This memory section can be broken down into smaller units, each unit holding information about a particular I/O device. This is termed a channel.

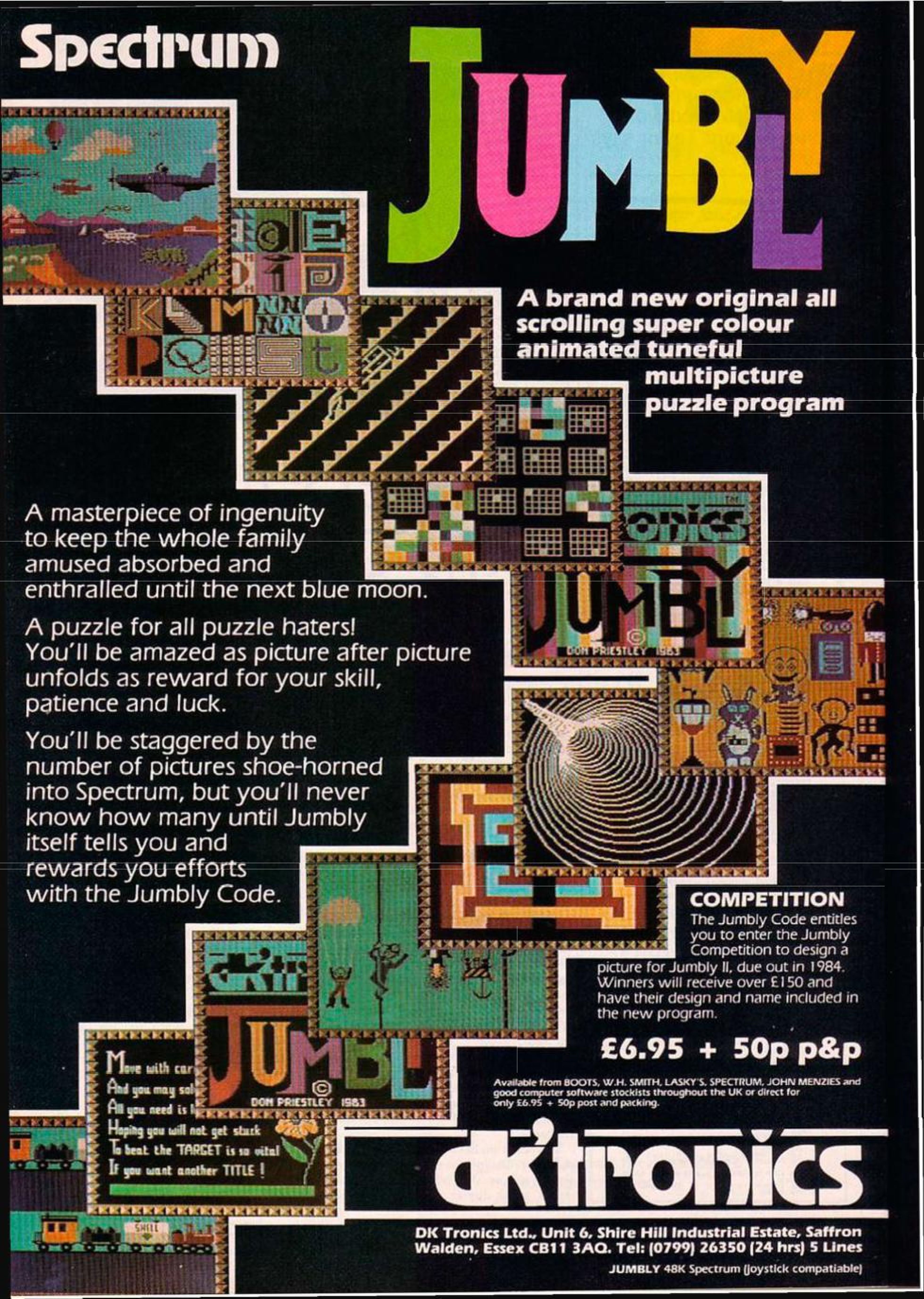
The Spectrum has four channels, denoted s, p, k and r. Channel s is an abbreviation for the screen and as you might expect, handles output to the display. Channel p stands for printer and handles output to this device, if connected. If you do not own a printer then this information is still stored but is obviously not used. Channel k stands for keyboard but handles both input and output. It inputs from the keyboard but also outputs to the bottom of the screen.

This is the area where lines are entered and edited. Channel r is not directly accessible to the user since it is used by the Spectrum for its own internal purposes. Now here's where the powerful bit comes in. For instance, when you use the Print command the output goes through channel s to the main part of the screen. You can, however, change their behaviour by cautious use of the Open# command which can make its output go through any other channel.

In addition to channels there are things termed streams which are associated with a particular channel. There are 16 streams, each one represented by a unique number from 0 and 15 inclusive. When you use the Print command its output goes through stream 2 which directs it towards channel s. The trick is to make stream 2 point to a different channel, not channel s. This is where the Open# command comes in.

This instruction has two arguments, the first is numeric and the second is a string type. The first one tells the computer which stream you are altering and the latter one gives the single character abbreviation of the channel you want

(continued on page 151)



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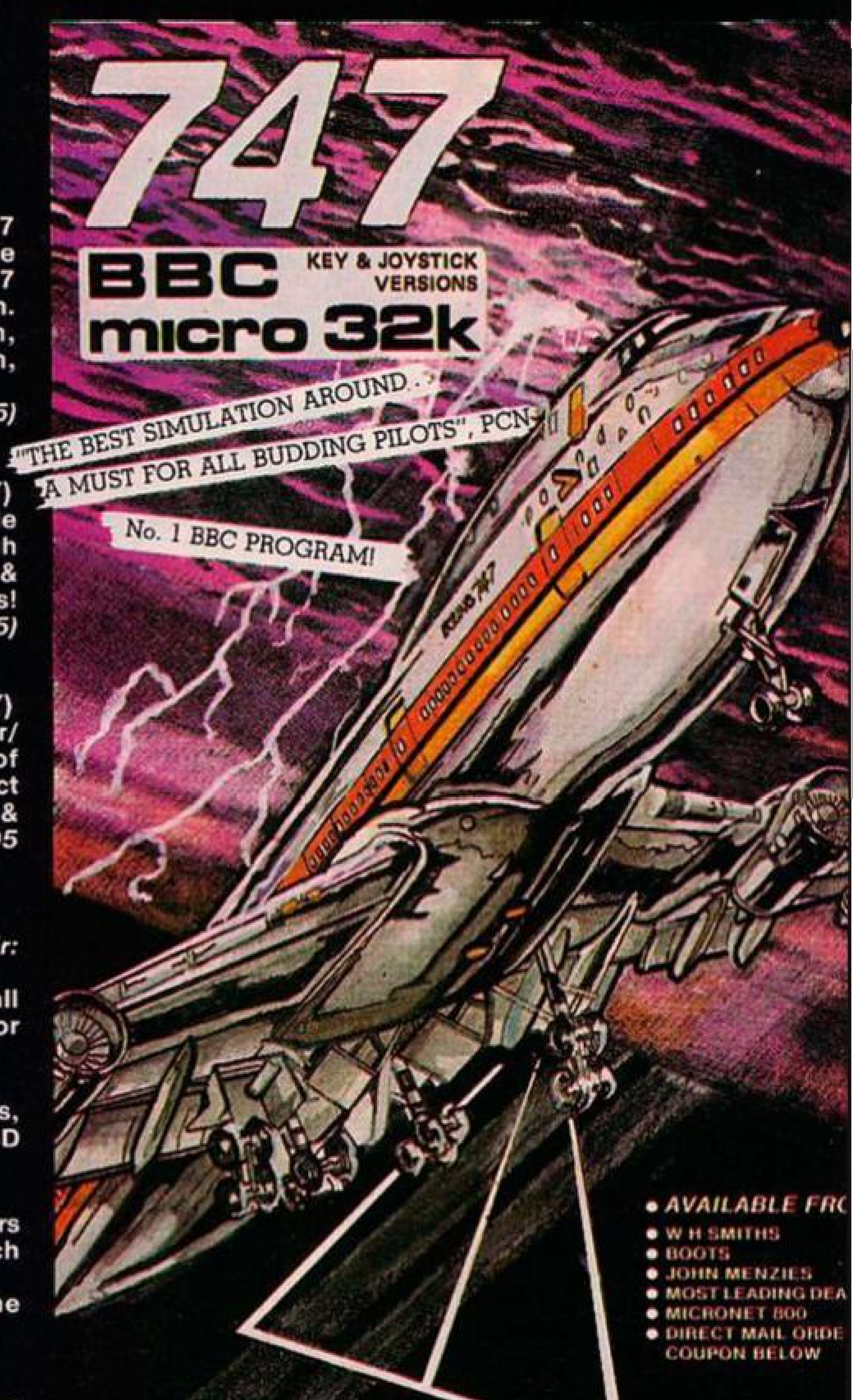
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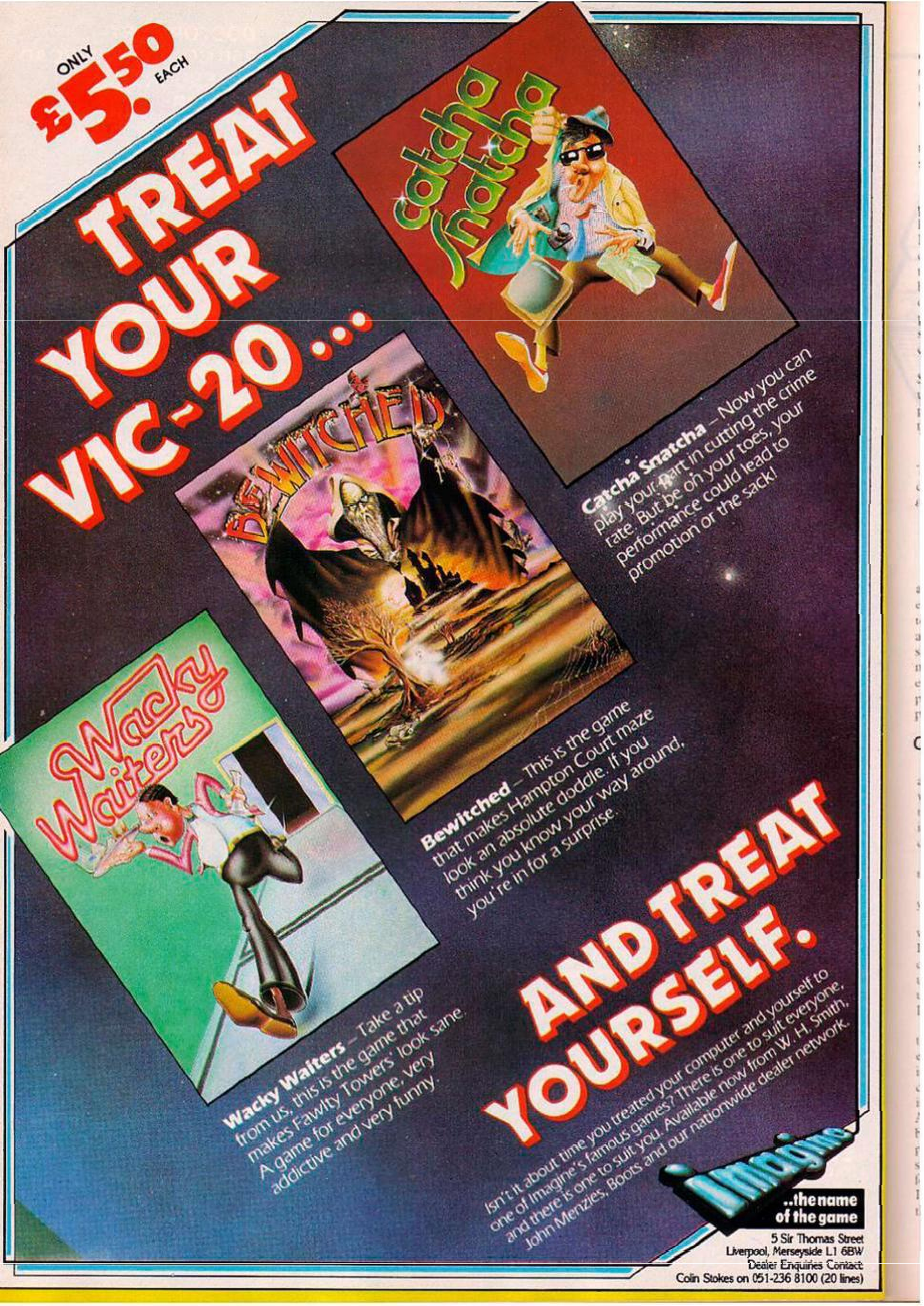
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(continued from page 147)
that stream to succeedingly point to. For example, type:

OPEN #2, k

This will make all Print statements output through channel k to the lower part of the screen. Now, to test this type:

PRINT "hello" : PAUSE 0

The pause 0 command prevents the production of an error report until you press a key as this would immediately obliterate the Printing. You will also find that the List command also uses stream 2 so it tries to list the program in the lower part of the screen, but this is not particularly successful. Printer owners may find it useful to write printer programs with output initially going to the screen while still using the LPrint or LList commands by entering:

OPEN#3, s

Stream 3 primarily points to channel p and is used by LPrint and LList. When you are positive that the program is debugged you can type:—

OPEN#3, p

This will revert stream 3 back to normal. This is a useful technique since it saves a good deal of time and printer paper. At switch on, only four of the 16 streams are used or opened.

Stream 0	#0	Points to channel k
Stream 1	#1	Points to channel k
Stream 2	#2	Points to channel s
Stream 3	#3	Points to channel p

The Spectrum operating system is protected against your upsetting the way in which the editor works — the routine which allows you to enter or edit lines in a program — and the automatic lister. Whatever is done to the streams, automatic listings will appear in the main part of the screen and lines will be entered or edited via the keyboard in the lower part of the screen. A stream which does not point to any channel at all is termed closed.

Closing down a stream

The Close # command's single numeric argument denotes the number of the stream which you want to close. The command makes that stream point to what it did on power-up, including nowhere at all. As you can see, you cannot actually close the first four streams.

For instance, in the last example, instead of typing

OPEN #3, p

you could have simply typed

CLOSE #3

which is certainly a much neater way. In Print, LPrint, List, LList, Input and Inkey$ commands you can alter the stream that is used by the command. For example, Print usually outputs on stream 2, its default stream. If you type:

PRINT #0; "Hello" : PAUSE 0

this will perform the same function as the first example did. The hash — # — symbol indicates to the computer that you wish to change the stream and must be followed by an integer value between 0 and 15 inclusive. Again, the Pause 0 is to prevent the word being immediately destroyed by the production of an error report. Printing in stream 0 gives you access to the previously forbidden lower two lines of the display. LPrint #2 is the same as Print and Print #3 is the same as LPrint.

You cannot use streams which are closed that is,

PRINT #12; "a"

will produce error "O Invalid stream". You can, however, easily open them using the Open # statement. The Input command uses a default of stream 0. Although it is possible to change the stream used by this command, only a stream pointing to channel k can be used. Any other does not allow input from the keyboard which is obviously essential. If you do try then error "J Invalid I/O device" will result.

Inkey$ works in a similiar way. As you can see, the use of streams in I/O statements, the Open # command and the Close # are very powerful. Perhaps the most useful thing is the ability to create new channels and make previously unused streams point to them. This method is used in the Play example.

The machine code for Play is held in a line 1 Rem statement. This is unusual since most Spectrum machine code is stored above RAMtop but this necessitates a different version for each memory size of machine. By storing the machine code in a Rem statement this problem is eliminated and so this program will run on both 16K and 48K machines. The machine code is represented by a decimal dump shown in listing 1. It is 226 bytes long. Type in a line 1 Rem followed by at least 226 0's. Now enter the rest of listing 2 which is a decimal loader program. Then carefully enter the decimal code from the first listing.

If you have made a mistake then the computer will tell you so when all the code has been entered. If this happens then enter the program given in listing 3 which will allow you to check your code against the original. You can then Poke in the correct values into locations in which you made a mistake. Delete the loader program and Save a copy of the program on tape.

To initialise the new channel a

RAND USR 23829

instruction is needed at the beginning of any program which uses Play. Now everytime you print through stream 4 — PRINT #4 — the Play routine will be called. It expects a string of characters which describe the tune to be played. This mainly consists of notes represented by the letters a to g. This, like the other parameters, can be in upper or lower case, it does not matter. If you want to play a sharp note then prefix the appropriate note with a hash character, for example:

RAND USR 23829: PRINT #4; "#ab"

This plays A sharp and then B. It is possible to change the octave by incorporating an exclamation mark followed by a number from 0 to 9. Middle C — represented by the number 0 in a Beep command — is in octave 5. Only the middle few octaves are any good for producing music as the others are so low in frequency that you can hear the individual clicks or so high that they can hardly be heard at all. The duration of the notes is controlled by the asterisk symbol, also followed by a number between 0 and 9 since there are 10 definable durations. They are defined as in table 1.

You can change these durations if you wish, using the short program given in listing 4. It will first prompt you for the duration number

Table 1.

Duration number	Length (seconds)
0	0.05
1	0.1
2	0.2
3	0.25
4	0.3
5	0.5
6	0.75
7	1
8	1.5
9	2

— 0 to 9 — you want to change. You will then be prompted for the new duration value in seconds. Anything from 0 to 10 is legal.

After using the

RAND USR 23829

the octave number is set to 5, the central octave. The duration is set to 4, which is initially 0.3 seconds. An example of the routine's use is given in listing 5. You will find that the machine code Rem statement will only partly list and then stop, preventing the rest of the listing. To circumvent this behaviour, type:

POKE 23660,10

and do not deliberately try to list the first line.

The information for each channel occupies five bytes. The first two bytes tell the computer the address of the routine that channel should use for output, this normally points to a routine in ROM. The next two bytes point to the address of the routine used for input. In all but channel k, this points to a routine which will produce error J. In channel k, however, this points to a routine which calculates which key is being pressed. The remaining byte is the code of the character which represents that channel. Program 1 prints information on all four channels.

Output routine addresses

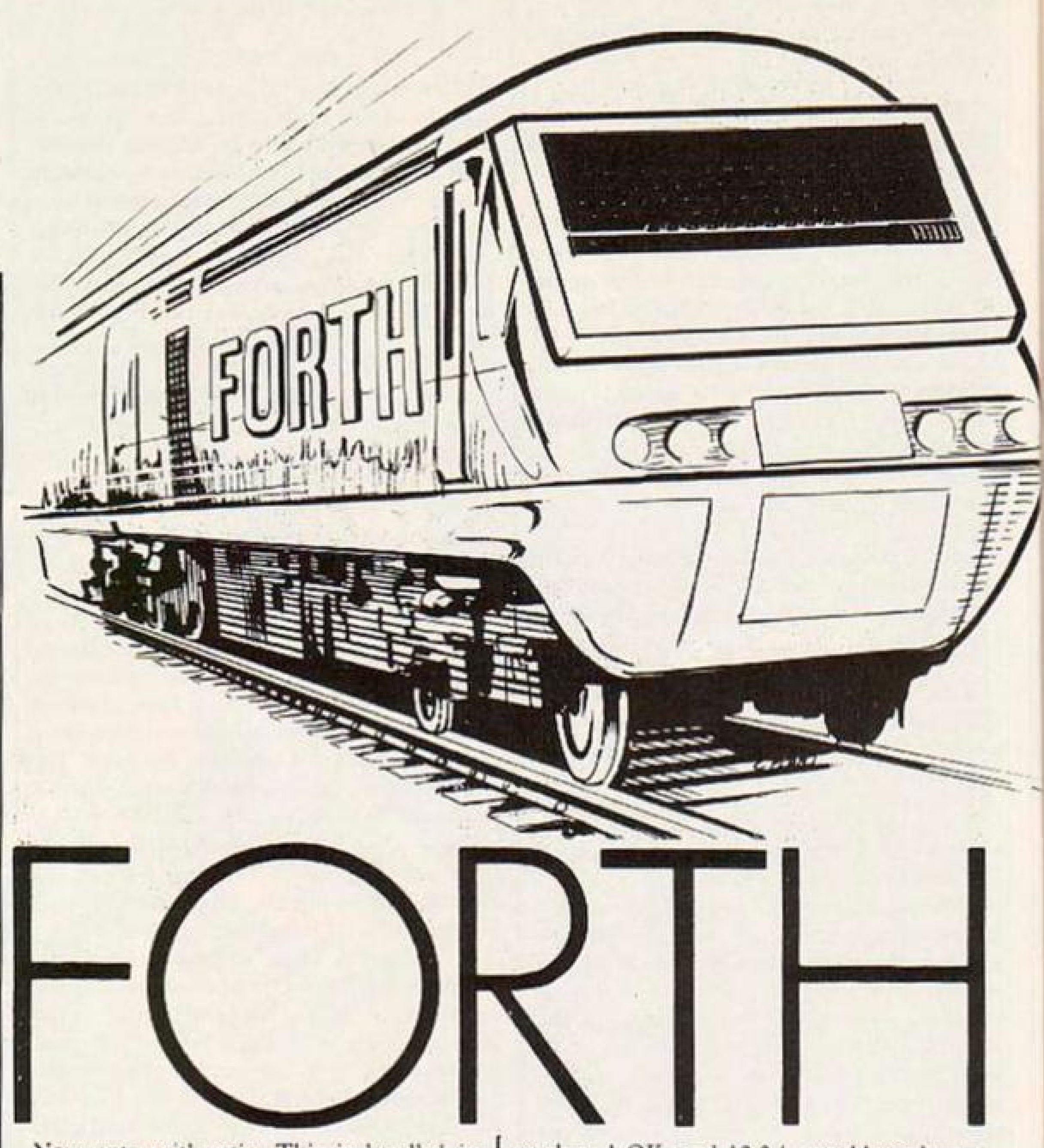
Notice how channels k, s and p all have the same output routine address. The difference between each channel is shown by flags, in the system variables, which are conditioned in a certain way for each individual channel. After all outputting to the two halves of the screen or to the printer is very similar except for a few small details. The stream information is held in the system variables between locations 23568 and 23605 inclusive.

Each stream occupies two bytes. Since there are 16 streams you might expect this area to be two bytes long but instead it is 38 bytes in length. This is because there are three extra streams which are not available to the user but are utilised by the editor and automatic listing routines to make sure that their output goes to the right place.

Anyway, each of these two bytes contains a relative displacement, from the byte before the channel information area, to the channel that is to be used. If the displacement is 0 then the stream is closed. The Play routine works by setting up five bytes of information for a new channel just at the beginning of the Rem statement. This is made to be pointed to by stream 4.

The computer unwittingly thinks that it is just printing to an ordinary channel in the proper information area. The potential applications of this are very powerful. ■

J C Cottrell explains the principles of Forth and describes a program for the BBC to imitate it.



BEFORE YOU BEGIN to use Forth, it helps to have some undertanding of how it differs from Basic. Forth is a compiled language — the computer takes your input, translates it into machine code, and stores the machine code, so that by the time you have entered the program, a complete machine language program is resident in memory. Basic is an interpreted language — the lines you type in are stored as they are typed, then when the program is executed, it is translated a line at a time to machine code, but the resultant code is not stored. This means that each line of program is translated as it is met and so considerably slows down execution. The important fact here is simply that Forth runs faster than Basic.

A fundamental point of any language is the method it uses to handle arithmetic. Forth uses a system known as Reverse Polish Notation or RPN. This method will be immediately familiar to anyone who has used a Hewlett Packard calculator. At any time a number is encountered in a line input by the user, it is placed in a position in memory known as the stack.

Any number being placed on the stack goes on the top, above all the other items; also when numbers are taken from the stack, these numbers come from the top. Therefore, the last number on the stack will be the first one off, and for this reason the stack is known as a last-in-first-out structure — LIFO structure.

A number is placed on the stack simply by typing this number and pressing Return. Typing 3 followed by Return would leave the number 3 on the stack. Now typing 4 and pressing Return will place 4 on top of the 3 already there. Incidentally, typing 3 4 followed by Return would produce the same effect. Note the importance of a space between the 3 and 4. This is an important convention in Forth — all words and separate numbers must be separated by at least one space, unlike Basic where spaces can often be omitted.

To print the top number on the stack in Forth a full stop is used. So typing 3 . followed by Return — remember the space between the 3 and the full stop — will place the 3 on top of the stack, and the full stop will print it, so 3 OK will appear on the screen. OK is the normal Forth response when no error has occurred.

Most Forth words remove any numbers from the stack that they use so that in the above example there would be nothing on the stack, the 3 having been removed from the stack by the full stop.

Now onto arithmetic. This is handled in Forth by the four words + * — / which perform the same functions as in Basic. Each one of these words expects two numbers on the stack, and the operation is applied to these two numbers. As is normal, the two numbers are removed from the stack. The result of the operation is stored on the stack.

For instance, 3 4 + followed by Return would place the 3 on the stack, and the 4 on top of it, the + would remove the 4 and the 3 and add them together and then leave the answer ,7, on top of the stack. Note that nothing would appear on the screen apart from the usual OK message. To print the answer, a . must be used to print the top number on the stack. The dot of course could have been included in the first line, to give 3 4 + . followed by Return, which would have printed 7 OK immediately.

Multiplication acts in a similar fashion, so 3 4 * . followed by Return would print 12 OK. But what about division and subtraction where the order of the two numbers is clearly important? The second number on the stack is either divided by, or subtracted from, the top number on the stack. So 4 3 — . would produce 1 OK, and 12 3 / . would produce a 4 OK.

In Forth, arithmetic is integer only, and numbers are rounded down to the nearest whole number after division. In the sort of application for which Forth is chosen, however, this is not as much of a problem as it might appear. There is also a group of words whose purpose is to directly manipulate the contents of the stack. These words are:

DUP. This makes a copy of the top number on the stack, and puts it on top of the original. Thus to calculate the square of a number: 3 DUP * . 9 OK is the response.

SWAP. This literally swaps over the top two numbers on the stack. For instance, if the top two numbers are 4,2 — in this and other examples, I place the top number on the left — after the SWAP, these numbers would be 2,4.

OVER. This will take a copy of the second item on the stack and put it on top of the top item e.g., before OVER: 3,4 after OVER: 4,3,4.

ROT. This goes further by rotating the top three items on the stack. The first item is removed, and pushed on top of the two to become the new top of stack e.g., before ROT: 1,2,3 after ROT: 3,1,2.

DROP. This simply removes the top item and forgets about it.

As well as the full stop to print a number, there is the word ." to print text. Spaces are very critical in Forth and this word is no

```
   10REM FORTH:MODE7
   20FOR I=&75 TO &8F:READ A:?I=A:NEXT
   30?&1A7A=96:END
   40DATA 113,23,124,26,0,239,39,0,0,0;0,0,122,26,0,0,
36,122,26,0,0,0,16,0,0,31,35
```

exception — it must be followed by a single space. So to print "HELLO" the sequence ."HELLO" will do the job. The last quote is not a Forth word, just a delimeter, so it needs no preceding space.

Forth has the words If and Then to handle conditionals. The usage of these words differ from Basic. The word If expects to find a flag on top of the stack. If this flag is true, then the computer will continue execution of the code following the If. A false result will send the computer on a search for the next Then. As soon as this is found, execution continues with the next word after Then.

The flags expected on the stack are produced by a series of words. These words are:

> takes the top two numbers on the stack. If the top number is greater than the second number, a true flag is placed on the stack, otherwise a false flag is placed there.

< is the logical inverse of >.

= compares the top two numbers. If they are equal, a true flag is left on the stack, otherwise a false flag is left there.

=0 takes the top number on the stack and compares it to zero. If it is zero, a true flag is left on the stack, otherwise a false flag is left there.

> gives a true flag if the top number on the stack is non-zero, otherwise gives a false flag.

As an example, type in two numbers, then the following sequence:

```
IF . SAME THEN
```

This will print SAME if the two numbers were equal. The = compares the top two numbers and leaves a flag on the stack. The If tests the flag. If it is false, a branch is made to the word following Then. Since this is the last word, however, control returns to the user. If the flag is true, execution continues with the printing of the word SAME.

Forth has three types of loop. There is the Begin . . Until loop, Begin . . While . . Repeat loop, and the Do . . Loop loop.

The Begin . . Until loop is used in a line such as:

```
BEGIN 1 0. ' UNTIL
```

The word Begin initialises the loop and has no other function. The Until will expect a flag on top of the stack, in this case placed there by the =0. The flag here will always be false, since one will never be equal to nought. The Until tests the top flag. If it is false, execution branches to the corresponding Begin. If the flag is true, execution continues with the next word.

Begin...While...Repeat

Begin . . While . . Repeat are enclosed in a program line in a smaller fashion to Begin . . Until. The Begin is again just a pointer. When the word While is encountered, the top flag on the stack is tested. If it is false, execution continues with the first word after Repeat. If it is true, execution continues with the next word after While. The Repeat will cause execution to continue with the next word after the corresponding Begin.

The Do . . Loop loop is Forth's equivalent of Basic's For . . Next loop. The Do expects two numbers on the stack. The first is the loop index, the second is the initial value of the loop index. The Loop will increment the loop index. If it exceeds the finish value, execution will proceed with the next word after Loop, otherwise the computer will branch to the word following the corresponding Do. There is a variation on this — the word +LOOP may be used instead of LOOP; Instead of incrementing the loop index, this adds the top number on the stack to the loop index, but otherwise functions as Loop.

There are various miscellaneous words present in this implementation of Forth. These are:

EMIT which takes the top number on the stack and prints the character with this ASCII code;

VDU which acts as the VDU statement in Basic. It takes as many numbers as necessary off the stack, from the top downwards;

! which is equivalent to Poke in most Basics. It stores the top number on the stack at the address pointed to by the second number on the stack;

@ which will fetch the contents of the address pointed to by the top number on the stack, and place this value on the stack;

+! which adds the top number on the stack to the address pointed to by the second number on the stack;

?KEY which expects a number on the stack. The word will wait for the length of time represented by this number in hundredths of a second, continually testing to see if a key is being pressed. When a key is pressed, its ASCII code is left on the stack. If no key is pressed before the time expires, 0 is left on the stack;

CMOVE which expects three numbers on the stack. These will be referred to as n1,n2,n3 with n1 coming from the top of the stack. The routine moves n3 bytes starting at the address n1 to the block of memory starting at address n2.

MOVE which acts as CMOVE except that it moves 16 bit words;

CR which prints a carriage-return, linefeed sequence on the screen;

SPACE which prints a single space on the screen;

(continued on next page)

Hex dump and ASCII (Forth 2).

```
1E98 : 00 2E 22 20 E8 86 71 84 .." ..q.
1EA0 : 72 A0 00 B1 71 C9 22 F0 r...q.".
1EA8 : 07 20 EE FF C8 4C A3 1E . ...L..
1EB0 : 60 FF 2B 20 A4 7E C0 04 `.+ .~..
1EB8 : B0 05 A9 01 4C 5B 13 B9 ....L[..
1EC0 : D6 16 88 88 18 79 D6 16 .....y..
1EC8 : 8D A6 15 88 B9 D6 16 C8 ........
1ED0 : C8 79 D6 16 88 88 99 D6 .y......
1ED8 : 16 C8 AD A6 15 99 D6 16 ........
1EE0 : 84 7E 60 00 2D 20 A4 7E .~`.- .~
1EE8 : C0 04 B0 05 A9 01 4C 5B ......L[
1EF0 : 13 B9 D6 16 8D A6 15 88 ........
1EF8 : 88 B9 D6 16 38 ED A6 15 ....8...
1F00 : 8D A6 15 88 B9 D6 16 C8 ........
1F08 : C8 F9 D6 16 88 88 99 D6 ........
1F10 : 16 C8 AD A6 15 99 D6 16 ........
1F18 : 84 7E 60 FF 2A 20 A9 00 .~`.* ..
1F20 : 8D A8 15 8D A9 15 A4 7E .......~
1F28 : C0 04 B0 05 A9 01 4C 5B ......L[
1F30 : 13 B9 D6 16 8D A6 15 88 ........
1F38 : B9 D6 16 8D A7 15 88 B9 ........
1F40 : D6 16 AA 20 58 1F 88 B9 ... X...
1F48 : D6 16 A8 C0 00 F0 25 A2 ......%.
1F50 : 00 20 58 1F 88 4C 4B 1F . X..LK.
1F58 : AD A8 15 18 6D A6 15 8D ....m...
1F60 : A8 15 AD A9 15 6D A7 15 .....m..
1F68 : 8D A9 15 CA E0 00 F0 03 ........
1F70 : 4C 58 1F 60 A4 7E 88 88 LX.`.~..
1F78 : AD A8 15 99 D6 16 88 AD ........
1F80 : A9 15 99 D6 16 C8 84 7E .......~
1F88 : 60 FF 2F 20 A9 00 8D 65 `./ ...e
1F90 : 19 8D 66 19 A4 7E C0 04 ..f..~..
1F98 : B0 05 A9 01 4C 5B 13 B9 ....L[..
1FA0 : D6 16 8D A8 15 88 B9 D6 ........
1FA8 : 16 8D A9 15 88 B9 D6 16 ........
1FB0 : 8D A6 15 88 B9 D6 16 8D ........
1FB8 : A7 15 AD A6 15 38 ED A8 .....8..
1FC0 : 15 8D A6 15 AD A7 15 E9 ........
1FC8 : 00 CD A7 15 D0 15 8D A7 ........
1FD0 : 15 CD A9 15 90 14 38 ED ......8.
1FD8 : A9 15 8D A7 15 20 FA 1F ..... ..
1FE0 : 4C BA 1F C9 FF F0 03 4C L......L
1FE8 : D1 1F AD 66 19 99 D6 16 ...f....
1FF0 : C8 AD 65 19 99 D6 16 84 ..e.....
1FF8 : 7E 60 AD 65 19 18 69 01 ~`.e..i.
2000 : 8D 65 19 AD 66 19 69 00 .e..f.i.
2008 : 8D 66 19 60 FF 2E 20 A4 .f.`.. .
2010 : 7E C0 02 B0 05 A9 01 4C ~......L
2018 : 5B 13 A9 00 A2 00 9D 6C [......l
2020 : 17 E8 E0 06 D0 F8 B9 D6 ........
2028 : 16 C9 00 F0 21 AD 71 17 ....!.q.
2030 : 18 69 01 C9 0A 90 08 A2 .i......
2038 : 05 20 A1 20 4C 42 20 8D . . LB .
2040 : 71 17 B9 D6 16 38 E9 01 q....8..
2048 : 99 D6 16 4C 29 20 88 B9 ...L) ..
2050 : D6 16 C9 00 F0 69 A9 06 .....i..
2058 : 18 6D 71 17 C9 0A 90 08 .mq.....
2060 : A2 05 20 A1 20 4C 6B 20 .. . Lk
2068 : 8D 71 17 A9 05 18 6D 70 .q....mp
2070 : 17 C9 0A 90 08 A2 04 20 .......
2078 : A1 20 4C 80 20 8D 70 17 . L. .p.
2080 : A9 02 18 6D 6F 17 C9 0A ...mo...
2088 : 90 08 A2 03 20 A1 20 4C .... . L
2090 : 95 20 8D 6F 17 B9 D6 16 . .o....
2098 : 38 E9 01 99 D6 16 4C 52 8.....LR
20A0 : 20 38 E9 0A 9D 6C 17 CA  8...l..
20A8 : BD 6C 17 18 69 01 C9 0A .l..i...
20B0 : F0 04 9D 6C 17 60 A9 00 ...l.`..
20B8 : 9D 6C 17 CA 4C A8 20 A2 .l..L. .
20C0 : 00 BD 6C 17 C9 00 D0 08 ..l.....
20C8 : E8 E0 06 F0 1A 4C C1 20 .....L.
20D0 : BD 6C 17 18 69 30 20 EE .l..i0 .
20D8 : FF E8 E0 06 D0 F2 88 84 ........
20E0 : 7E A9 20 20 EE FF 60 A9 ~.  ..`.
20E8 : 30 20 EE FF 88 84 7E A9 0 ....~.
20F0 : 20 20 EE FF 60 00 44 55   ..`.DU
20F8 : 50 20 A4 7E C0 02 B0 05 P .~....
2100 : A9 01 4C 5B 13 B9 D6 16 ..L[....
2108 : AA 88 B9 D6 16 C8 C8 99 ........
2110 : D6 16 C8 8A 99 D6 16 84 ........
2118 : 7E 60 FF 53 57 41 50 20 ~`.SWAP
2120 : A4 7E C0 04 B0 05 A9 01 .~......
2128 : 4C 5B 13 B9 D6 16 8D A6 L[......
2130 : 15 88 B9 D6 16 8D A7 15 ........
2138 : 88 B9 D6 16 AA 88 B9 D6 ........
2140 : 16 C8 C8 99 D6 16 C8 8A ........
2148 : 99 D6 16 AD A6 15 88 88 ........
2150 : 99 D6 16 AD A7 15 88 99 ........
2158 : D6 16 60 00 4F 56 45 52 ..`.OVER
2160 : 20 A4 7E C0 04 B0 05 A9  .~.....
2168 : 01 4C 5B 13 88 88 B9 D6 .L[.....
2170 : 16 AA 88 B9 D6 16 A4 7E .......~
2178 : C8 99 D6 16 C8 8A 99 D6 ........
2180 : 16 84 7E 60 00 52 4F 54 ..~`.ROT
2188 : 20 A4 7E C0 06 B0 05 A9  .~.....
2190 : 01 4C 5B 13 B9 D6 16 8D .L[.....
2198 : A6 15 88 B9 D6 16 8D A7 ........
21A0 : 15 88 B9 D6 16 8D A8 15 ........
21A8 : 88 B9 D6 16 8D A9 15 88 ........
21B0 : B9 D6 16 AA 88 B9 D6 16 ........
21B8 : 86 83 AA A5 83 A4 7E 99 ......~.
21C0 : D6 16 88 8A 99 D6 16 88 ........
21C8 : AD A6 15 99 D6 16 88 AD ........
21D0 : A7 15 99 D6 16 88 AD A8 ........
21D8 : 15 99 D6 16 88 AD A9 15 ........
21E0 : 99 D6 16 60 00 44 52 4F ...`.DRO
21E8 : 50 20 A4 7E C0 02 B0 05 P .~....
21F0 : A9 01 4C 5B 13 88 88 84 ..L[....
21F8 : 7E 60 00 3D 20 20 AE 13 ~`.=  ..
2200 : AD A6 15 CD A8 15 D0 13 ........
2208 : AD A7 15 CD A9 15 D0 08 ........
2210 : A4 7E C8 A9 01 99 D6 16 .~......
2218 : 84 7E 60 A9 00 A4 7E C8 .~`...~.
2220 : 99 D6 16 84 7E 60 FF 3E ....~`.>
2228 : 20 20 AE 13 AD A7 15 CD   ......
2230 : A9 15 F0 0D B0 15 A9 00 ........
2238 : A4 7E C8 99 D6 16 84 7E .~.....~
2240 : 60 AD A6 15 CD A8 15 F0 `.......
2248 : ED 90 EB A9 01 4C 38 22 .....L8"
2250 : 60 00 3C 20 20 AE 13 AD `.<  ...
2258 : A7 15 CD A9 15 F0 0D 90 ........
2260 : 13 A9 00 A4 7E C8 99 D6 ....~...
2268 : 16 84 7E 60 AD A6 15 CD ..~`....
2270 : A8 15 B0 ED A9 01 4C 63 ......Lc
2278 : 22 60 00 3D 30 20 20 92 "`.=0  .
2280 : 13 AD A6 15 C9 00 D0 12 ........
2288 : AD A7 15 C9 00 D0 08 A9 ........
2290 : 01 A4 7E C8 99 D6 16 84 ..~.....
2298 : 7E 60 A9 00 4C 91 22 60 ~`..L."`
22A0 : FF 3E 30 20 20 92 13 AD .>0  ...
22A8 : A6 15 C9 00 D0 12 AD A7 ........
22B0 : 15 C9 00 D0 08 A9 00 A4 ........
22B8 : 7E C8 99 D6 16 84 7E 60 ~.....~`
22C0 : A9 01 4C B7 22 60 FF 49 ..L."`.I
22C8 : 46 20 A4 7E C0 01 B0 05 F .~....
22D0 : A9 01 4C 5B 13 B9 D6 16 ..L[....
22D8 : 88 84 7E C9 00 F0 01 60 ..~....`
22E0 : A9 20 8D 92 15 A5 8E 8D . ......
22E8 : 93 15 A5 8F 8D 94 15 A9 ........
22F0 : 0D 8D 95 15 68 85 81 68 ....h..h
22F8 : 85 82 A9 63 85 8A 20 AF ...c.. .
2300 : 0F A9 00 85 8A A5 81 85 ........
```

(listing continued on next page)

(continued from previous page)

SPACES which takes the top number on the stack, and prints this number of spaces on the screen.

Variable handling is achieved in Forth in the following way: A variable is set up using the word Variable. For example:

VARIABLE JIMMY

creates Jimmy as a variable, and assigns it an address to store its contents. Executing the word Jimmy puts this address on the stack. Thus variables are read using @, written to using !, and added to using +!. So to set Jimmy to 23, the sequence

23 JIMMY

will do the job. Similarly, to print the contents of Jimmy, use JIMMY @. and to add 12 to Jimmy use

12 JIMMY +!

String handling is rather complex. The separate bytes of a text string are stored in memory, preceded by a length counter, indicating length of string. To set up a string, the word Variable is used, followed by the name of the string, followed by the maximum length of string, followed by the word Allot. So to set up a string Fred with a maximum length of 10 characters, use the sequence

VARIABLE FRED 10 ALLOT

The contents of the string must either be moved from somewhere else in memory using Move, or else stored byte by byte using !. There is, however, an easier way to print out the string than removing it byte by byte using @ and then printing each byte using Emit. Instead, the word Type may be used. To set up the parameters for Type, the word Count is used. Count expects the address of the start of the string on the stack. It is assumed that this is the address of the length byte and that the string itself starts at this address plus one.

When Count has been used in this manner, Type will print a string on the screen. Finally, to remove any trailing spaces on the end of the string, the word — Trailing is used. It expects the address of the first character of the string on top of the stack, and the length count of the string just below this. When it has altered the length count to exclude trailing spaces, the string address is left on top of the stack, followed by the new length count.

Any word sequence

The above section has dealt simply with the actions of words. Any sequence of words may be used, and any results will be displayed as soon as you press Return. This is not programming. A program in Forth consists of a list of defined words. An analogy may be helpful at this stage.

A program consists of a number of actions, referred to as words. These words are combined in further definitions until the whole program consists of a single word. The program is run by typing in this word.

To write a program, the specification of the task must be decided upon. This single action is broken down into groups of smaller actions, and each action in these groups itself broken down, until the stage is reached when the list may be easily converted to Forth code.

As an example, take brushing your teeth in the morning. The whole action could be regarded as one word, Teeth. In pseudo-Forth the code would look something like this:

```
: TEETH
BRUSH PASTE CLEAN;
```

In Forth, a colon indicates a word definition and a semi-colon an end of word definition. Each word could be defined as follows:

```
:BRUSH
OPEN-CUPBOARD GET BRUSH
CLOSE-CUPBOARD;

:PASTE
GET-PASTE SQUEEZE TUBE
DROP-PASTE;

:CLEAN
SCRUB RINSE;
```

and each word in these definitions could be defined themselves, until the only words in the definitions are those provided in the Forth system. The only other thing you need to know to write programs is the format of a word name. It must be no more than 20 characters long and may include any character except a space — upper and lower case letters, numbers and symbols are all equally acceptable.

For storing your Forth programs, the two words Load and Save are provided. These act as in Basic except that files are numbered rather than named. Numbers should be in the

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Use this hex loader to type in the hex dump (Forth 2) listing. Enter the two-character hex numbers row by row, beginning with the 2E (at addres &1E99) in the top row. Press <RETURN> after each entry.

```
10 REM HEX LOADER
20 CLS:PRINT"Start at the beginning? (Y/N)";X=GET AND &DF
30 IF X=89 THEN a%=&1E99 ELSE PROCno
40 FOR N=a% TO &2777
50 IF N MOD 8=0 PRINT''CHR$134;"Next row: ":PROCsound(157)
60 REPEAT
70 ONERROR GOTO260
80 PRINT''"Address &";~N;": ";
90 INPUT"input hex data, &"b$
100 IF LEN(b$)<>2 THEN PROCsound(129):GOTO80
110 b$="&"+b$:b%=EVAL(b$)
120 UNTIL b%<&100
130 ?N=b%
140 NEXT
150 PRINT''CHR$131;CHR$136;"That's the lot'":PROCsound(85)
160 END
170 DEFPROCno
180 REPEAT
190 INPUT "Where would you like to start? &"a$
200 a$="&"+a$:a%=EVAL(a$)
210 UNTIL a%>&1E99 AND a%<&2778
220 ENDPROC
230 DEFPROCsound(a%)
240 SOUND1,-10,a%,5
250 ENDPROC
260 IF ERR<>17 THEN PROCsound(45):PRINT ERR:END
```

(listing continued from previous page)

```
2308 : 8C A5 82 85 8D A5 86 85 ........
2310 : 81 A5 87 85 82 6C 8C 00 .....l..
2318 : 60 FF 54 48 45 4E 20 60 `.THEN `
2320 : FF 42 45 47 49 4E 20 68 .BEGIN h
2328 : AA 68 48 A8 8A 48 AE 8B .hH..H..
2330 : 19 E8 9D 8C 19 98 E8 9D ........
2338 : 8C 19 8E 8B 19 60 FF 55 ......`.U
2340 : 4E 54 49 4C 20 AE 8B 19 NTIL ...
2348 : 68 68 8D 8C 19 48 CA 8D hh...H..
2350 : 8C 19 48 60 00 57 48 49 ..H`.WHI
2358 : 4C 45 20 A4 7E C0 01 B0 LE .~...
2360 : 03 4C 5B 13 B9 D6 16 88 .L[.....
2368 : 84 7E C9 00 D0 47 AE 8B .~...G..
2370 : 19 CA CA 8E 8B 19 A9 20 .......
2378 : 8D 92 15 AD 5D 1A 8D 93 ....]...
2380 : 15 AD 5E 1A 8D 94 15 A9 ..^.....
2388 : 0D 8D 95 15 68 85 81 68 ....h..h
2390 : 85 82 A9 63 85 8A 20 AF ...c.. .
2398 : 0F A9 00 85 8A A5 81 18 ........
23A0 : 69 02 85 81 A5 82 69 00 i.....i.
23A8 : 48 A5 81 48 A5 86 85 81 H..H....
23B0 : A5 87 85 82 EA 60 FF 52 .....`.R
23B8 : 45 50 45 41 54 20 AE 8B EPEAT ..
23C0 : 19 68 68 8D 8C 19 48 CA .hh...H.
23C8 : 8D 8C 19 48 60 00 44 4F ...H`.DO
23D0 : 20 AE 8B 19 E8 E8 E8 A4  .......
23D8 : 7E B9 D6 16 9D 8C 19 88 ~.......
23E0 : E8 B9 D6 16 9D 8C 19 88 ........
23E8 : E8 B9 D6 16 9D 8C 19 88 ........
23F0 : E8 B9 D6 16 9D 8C 19 88 ........
23F8 : 84 7E 68 AA 68 48 A8 8A .~h.hH..
2400 : 48 AE 8B 19 E8 9D 8C 19 H.......
2408 : 98 E8 9D 8C 19 8E 8B 19 ........
2410 : AD 8B 19 18 69 04 8D 8B ....i...
2418 : 19 60 FF 41 4C 4C 4F 54 .`.ALLOT
2420 : 20 A4 7E B9 D6 16 18 65  .~....e
2428 : 77 85 77 88 B9 D6 16 65 w.w....e
2430 : 78 85 78 88 84 7E 60 FF x.x..~`.
2438 : 45 4D 49 54 20 A4 7E B9 EMIT .~.
2440 : D6 16 20 EE FF 88 88 84 .. .....
2448 : 7E 60 00 21 20 A4 7E B9 ~`.! .~.
2450 : D6 16 8D A6 15 88 B9 D6 ........
2458 : 16 8D A7 15 88 B9 D6 16 ........
2460 : 85 71 88 B9 D6 16 85 72 .q.....r
2468 : 88 84 7E A0 00 AD A6 15 ..~.....
2470 : 91 71 C8 AD A7 15 91 71 .q.....q
2478 : 60 00 40 20 A4 7E B9 D6 `.@ .~..
2480 : 16 85 71 88 B9 D6 16 85 ..q.....
2488 : 72 84 7E A0 00 B1 71 8D r.~...q.
2490 : A6 15 C8 B1 71 A4 7E 99 ....q.~.
2498 : D6 16 AD A6 15 C8 99 D6 ........
24A0 : 16 84 7E 60 FF 2B 21 20 ..~`.+!
24A8 : A4 7E B9 D6 16 8D 6A 1A .~....j.
24B0 : 88 B9 D6 16 8D 69 1A 88 .....i..
24B8 : B9 D6 16 8D A8 15 88 B9 ........
24C0 : D6 16 8D A9 15 C8 84 7E .......~
24C8 : 20 7C 24 A4 7E B9 D6 16  |$.~...
24D0 : 18 6D 6A 1A 8D 6A 1A 88 .mj..j..
24D8 : B9 D6 16 6D 69 1A 8D 69 ...mi..i
24E0 : 1A AD A8 15 99 D6 16 C8 ........
24E8 : AD A9 15 99 D6 16 C8 AD ........
24F0 : A6 15 99 D6 16 C8 AD A7 ........
24F8 : 15 99 D6 16 84 7E 20 4D ......~ M
2500 : 24 60 00 3F 4B 45 59 20 $`.?KEY
2508 : A4 7E B9 D6 16 AA 88 B9 .~......
2510 : D6 16 84 7E A8 A9 81 20 ...~...
2518 : F4 FF C0 00 D0 0F A9 00 ........
2520 : A4 7E 99 D6 16 8A C8 99 .~......
2528 : D6 16 84 7E 60 A2 00 4C ...~`..L
2530 : 1E 25 60 FF 43 4D 4F 56 .%`.CMOV
2538 : 45 20 A4 7E 88 88 88 88 E .~....
2540 : B9 D6 16 8D A6 15 88 B9 ........
2548 : D6 16 8D A7 15 AD A7 15 ........
2550 : C9 00 D0 0F AD A6 15 C9 ........
2558 : 00 D0 08 A5 7E 38 E9 06 ....~8..
2560 : 85 7E 60 A4 7E B9 D6 16 .~`.~...
2568 : 85 71 88 B9 D6 16 85 72 .q.....r
2570 : A0 00 B1 71 8D A8 15 A4 ...q....
2578 : 7E 88 88 B9 D6 16 85 71 ~......q
2580 : 88 B9 D6 16 85 72 A0 00 .....r..
2588 : AD A8 15 91 71 A4 7E B9 ....q.~.
2590 : D6 16 18 69 01 99 D6 16 ...i....
2598 : 88 B9 D6 16 69 00 99 D6 ....i...
25A0 : 16 88 B9 D6 16 18 69 01 ......i.
25A8 : 99 D6 16 88 B9 D6 16 69 .......i
25B0 : 00 99 D6 16 AD A6 15 38 .......8
25B8 : E9 01 8D A6 15 AD A7 15 ........
25C0 : E9 00 8D A7 15 4C 40 25 .....LM%
25C8 : 60 00 4D 4F 56 45 20 A4 `.MOVE .
25D0 : 7E 88 88 88 88 B9 D6 16 ~.......
25D8 : 8D A6 15 88 B9 D6 16 8D ........
25E0 : A7 15 AD A6 15 18 6D A6 ......m.
25E8 : 15 8D A6 15 AD A7 15 6D .......m
25F0 : A7 15 8D A7 15 4C 40 25 .....LM%
25F8 : 60 00 43 4F 55 4E 54 20 `.COUNT
2600 : A4 7E B9 D6 16 18 85 71 .~.....q
2608 : 69 02 8D A6 15 88 B9 D6 i.......
2610 : 16 85 72 69 00 8D A7 15 ..ri....
2618 : A9 00 99 D6 16 C8 84 7E .......~
2620 : A0 00 B1 71 A4 7E 99 D6 ...q.~..
2628 : 16 C8 AD A7 15 99 D6 16 ........
2630 : C8 AD A6 15 99 D6 16 84 ........
2638 : 7E 60 FF 43 52 20 20 E7 ~`.CR  .
2640 : FF 60 FF 53 50 41 43 45 .`.SPACE
2648 : 20 A9 20 20 EE FF 60 00  .  ..`.
2650 : 53 50 41 43 45 53 20 A4 SPACES .
2658 : 7E B9 D6 16 AA E0 00 F0 ~.......
2660 : 09 A9 20 20 EE FF CA 4C ..   ...L
2668 : 5D 26 88 88 84 7E 60 00 ]&...~`.
2670 : 54 59 50 45 20 A4 7E B9 TYPE .~.
2678 : D6 16 85 71 88 B9 D6 16 ...q....
2680 : 85 72 88 B9 D6 16 8D A6 .r......
2688 : 15 88 88 84 7E A0 00 CC ....~...
2690 : A6 15 F0 09 B1 71 20 EE .....q .
2698 : FF C8 4C 8F 26 60 FF 2D ..L.&`.-
26A0 : 54 52 41 49 4C 49 4E 47 TRAILING
26A8 : 20 A4 7E B9 D6 16 85 71  .~....q
26B0 : 88 B9 D6 16 85 72 88 B9 .....r..
26B8 : D6 16 18 8D A6 15 65 71 ......eq
26C0 : 85 71 A5 72 69 00 85 72 .q.ri..r
26C8 : 88 84 7E AE A6 15 A0 00 ..~.....
26D0 : B1 71 C9 00 D0 11 CA A5 .q......
26D8 : 71 38 E9 01 85 71 A5 72 q8...q.r
26E0 : E9 00 85 72 4C D0 26 A4 ...rL.&.
26E8 : 7E 8A 99 D6 16 C8 C8 84 ~.......
26F0 : 7E 60 00 56 44 55 20 A4 ~`.VDU .
26F8 : 7E B9 D6 16 AA 88 88 84 ~.......
2700 : 7E 20 EE FF C9 20 B0 1E ~ ... ..
2708 : 8D 77 1E A8 C0 00 F0 16 .w......
2710 : 88 8C A6 15 A4 7E B9 D6 .....~..
2718 : 16 88 88 84 7E 20 EE FF ....~ ..
2720 : AC A6 15 4C 0C 27 60 FF ...L.'`.
2728 : 53 41 56 45 20 A9 8C 85 SAVE ...
2730 : 71 A9 60 85 72 A4 7E B9 q.`.r.~.
2738 : D6 16 88 88 84 7E 18 69 .....~.i
2740 : 30 8D A6 15 A2 A6 A0 15 0.......
2748 : A9 0D 8D A7 15 A9 80 20 .......
2750 : CE FF 8D A8 15 A0 00 B1 ........
2758 : 71 AC A8 15 20 D4 FF A5 q... ...
2760 : 71 C5 7A F0 10 A5 71 18 q.z...q.
2768 : 69 01 85 71 A5 72 69 00 i..q.ri.
2770 : 85 72 4C 55 27 A5 72 C5 .rLU'.r.
```

(continued from page 154)

range 1-15. So to Save the current user-defined vocabulary with a file number of 6.

6 SAVE

will achieve the desired result. And to load this back again, use

6 LOAD

This brief summary should have got you to the point where it is possible for you to write programs in Forth, so I will move on to the machine-specific features of my BBC compiler.

As a start, enter the first, short program, and Save it on tape. Next, enter the second program. Save this on a separate tape. Now insert the tape you used to Save the first program and position it after this program. Type Run. Now type

`SAVE FORTH1 4700 578D 4700

Press play and record on your tape recorder, and press Return. Stop the tape when the computer has finished recording.

Now enter the final program. Save this after the text of the second program on your second tape. These copies are not functional; their purpose is to help you to correct any mistakes. Run the program as before, then insert your original tape, and Save the code using

`SAVE FORTH2 5790 606E 5790

You can now use the program from this tape. Use

CHAIN

to load the first part,

LOAD E0D

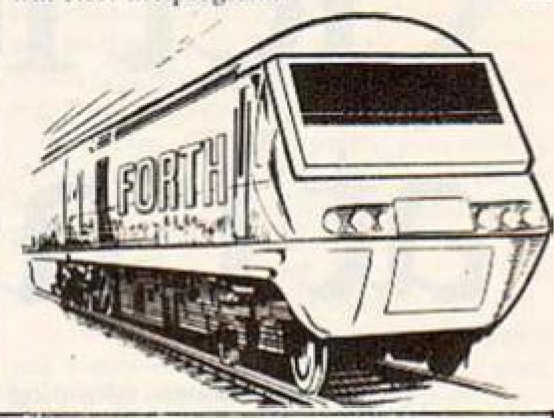
for the second part, and

`LOAD ' 1E99

for the last part. When the last part has loaded

CALL &E0D

will start the program. ■



Forth 1 listing

```
10 P%=&0E0D:[:LDX #&00:LDA &1A6B,X:CMP #&0D:BEQ P%+&09
20 JSR &FFEE:INX:JMP &0E0F:JSR &FFE7:JSR &FFE7:TSX:STX &70
30 LDA #&00:STA &7E:LDA #&4F:JSR &FFEE:LDA #&4B:JSR &FFEE
40 JSR &FFE7:JSR &FFE7:LDA #&5D:JSR &FFEE:LDX #&00:JSR &FFE0
50 CMP #&1B:BNE P%+&05:JMP &0F50:CMP #&3A:BNE P%+&08:LDA #&63
60 STA &79:LDA #&3A:CMP #&3B:BNE P%+&08:LDA #&00:STA &79
70 LDA #&3B:CMP #&7F:BNE P%+&09:DEX:JSR &FFEE:JMP &0E41
80 CMP #&09:BNE P%+&13:LDA #&20:JSR &FFEE:JSR &FFEE:JSR &FFEE
90 JSR &FFEE:JMP &0E41:JSR &FFEE:STA &15AA,X:INX:CMP #&0D
100 BNE P%-&47:JSR &FFE7:LDA &79:CMP #&63:BNE P%+&0C:DEX
110 LDA #&20:STA &15AA,X:INX:JMP &0E41:DEX:LDA #&20:STA &15AA,X
120 INX:LDA #&0D:STA &15AA,X:LDX #&00:LDA &15AA,X:CMP #&3A
130 BNE P%+&05:JMP &11B8:CMP #&0D:BEQ P%+&52:CMP #&20:BNE P%+&06
140 INX:JMP &0EAB:CMP #&30:BCC P%+&49:CMP #&3A:BCS P%+&45
150 STX &84:JSR &1039:LDX &7D:LDA #&A2:STA &1640,X:INX:LDA &80
160 STA &1640,X:INX:LDA #&A0:STA &1640,X:INX:LDA &7F:STA &1640,X
170 INX:LDA #&20:STA &1640,X:INX:LDA &85:STA &1640,X:INX:LDA &8B
180 STA &1640,X:INX:STX &7D:LDX &84:INX:LDA &15AA,X:CMP #&20
190 BNE P%-&06:JMP &0EBD:JMP &0F3F:LDA #&32:STA &1A58:JSR &13CD
200 LDA &1A23:CMP #&63:BEQ P%-&5C:JSR &0F56:LDX &83:DEX:DEX
210 LDA &15AA,X:CMP #&2E:BNE P%+&0D:INX:LDA &15AA,X:CMP #&22
220 BEQ P%+&0A:JMP &0F35:INX:INX:JMP &0EBD:JSR &1137:JMP &0EBD
230 LDX &7D:LDA #&60:STA &1640,X:LDA #&00:STA &7D:JSR &1640
240 JMP &0E2A:LDA #&7E:JSR &FFF4:RTS:LDY #&00:LDA &15AA,X
250 CMP #&20:BEQ P%+&0A:STA &1592,Y:INX:INY:JMP &0F58:LDA #&0D
260 STA &1592,Y:STX &83:JSR &0FAF:LDX &7D:LDA #&20:STA &1640,X
270 INX:LDY #&00:JSR &0F8A:LDA (&81),Y:CMP #&20:BNE P%-&07
280 JSR &0F8A:JMP &0F98:LDA &81:CLC:ADC #&01:STA &81:LDA &82
290 ADC #&00:STA &82:RTS:LDA &81:STA &1640,X:INX:LDA &82
300 STA &1640,X:INX:STX &7D:LDA &86:STA &81:LDA &87:STA &82:RTS
310 LDY #&00:LDA &8A:CMP #&63:BEQ P%+&0E:LDA (&81),Y:CMP #&60
320 BEQ P%+&38:JSR &0FD0:JMP &0FB7:LDA (&81),Y:CMP &1592
330 BEQ P%+&58:JSR &0FD0:JMP &0FC3:LDA &81:CMP #&FF:BEQ P%+&0D
340 ADC #&01:STA &81:LDA &82:ADC #&00:STA &82:RTS:LDA &82
350 CMP &78:BEQ P%+&07:LDA &81:JMP &0FD6:LDA #&00:STA &82
360 JMP &135B:JSR &0FD0:JSR &0FD0:LDA &8A:CMP #&63:BNE P%+&06
370 CPY #&03:BEQ P%+&1E:LDA (&81),Y:CMP #&20:BEQ P%+&11
380 CMP &1592,Y:BNE P%+&06:INY:JMP &0FF9:JSR &0FD0:JMP &0FAF
390 LDA &1592,Y:CMP #&0D:BNE P%-&0B:RTS:INY:JMP &0FF9:STX &80
400 STY &7F:LDA &80:LDX &7E:INX:STA &16D6,X:LDA &7F:INX
410 STA &16D6,X:STX &7E:RTS:LDA #&00:STA &80:INX:LDA &15AA,X
420 CMP #&20:BNE P%-&06:LDY #&01:LDA #&00:DEX:CPY #&06
430 BEQ P%+&09:STA &176C,Y:INY:JMP &104A:DEY:CPX #&FF:BEQ P%+&14
440 LDA &15AA,X:CMP #&20:BEQ P%+&0D:SEC:SBC #&30:STA &176C,Y:DEX
450 DEY:JMP &1056:LDX #&01:LDA &176C,X:CMP #&00:BNE P%+&29:INX
460 LDA &176C,X:CMP #&00:BNE P%+&21:INX:LDA &176C,X:CMP #&03
470 BCS P%+&19:CMP #&02:BCC P%+&18:INX:LDA &176C,X:CMP #&06
480 BCS P%+&0D:INX:LDA &176C,X:CMP #&06:BCS P%+&05:JMP &109F
490 JMP &10CB:LDA &176F:TAY:LDA #&00:CPY #&00:BEQ P%+&09:CLC
500 ADC #&64:DEY:JMP &10A5:TAX:LDA &1770:TAY:TXA:CPY #&00
510 BEQ P%+&09:CLC:ADC #&0A:DEY:JMP &10B6:CLC:ADC &1771:STA &7F
520 RTS:LDA &15AA,X:LDA &80:CLC:ADC #&01:STA &80:LDA &1771:SEC
530 SBC #&06:STA &1771:CMP #&0A:BCC P%+&0D:CLC:ADC #&0A
540 STA &1771:LDY #&04:JSR &1120:LDA &1770:SEC:SBC #&05
550 STA &1770:CMP #&0A:BCC P%+&0D:CLC:ADC #&0A:STA &1770
560 LDY #&03:JSR &1120:LDA &176F:SEC:SBC #&02:STA &176F:CMP #&0A
570 BCS P%+&05:JMP &106C:CLC:ADC #&0A:STA &176F:LDY #&02
580 JSR &1120:JMP &106C:LDA &176C,Y:CMP #&00:BEQ P%+&09:SEC
590 SBC #&01:STA &176C,Y:RTS:LDA #&09:STA &176C,Y:DEY:JMP &1120
600 LDA &7A:STA &1987:LDA &7B:STA &1988:LDY &7D:LDA &1989
610 STA &7A:LDA &198A:STA &7B:JSR &115D:STY &7D:LDA &1987
620 STA &7A:LDA &1988:STA &7B:RTS:DEY:LDA (&7A),Y:STA &80:DEY
630 LDA (&7A),Y:STA &7F:DEY:LDA #&A2:STA (&7A),Y:INY:INX:STY &84
640 LDY #&00:LDA &15AA,X:STA (&75),Y:CMP #&22:BEQ P%+&07:INX:INY
650 JMP &1172:INY:STY &74:LDY &84:LDA &75:STA (&7A),Y:INY
660 LDA #&A0:STA (&7A),Y:INY:LDA &76:STA (&7A),Y:INY:LDA #&20
670 STA (&7A),Y:LDA &7F:INY:STA (&7A),Y:INY:LDA &80:STA (&7A),Y
680 INX:INY:LDA &74:CLC:ADC &75:STA &75:LDA &76:ADC #&00:STA &76
690 LDA #&00:STA &80:STA &7F:RTS:LDY #&00:INX:JSR &12A5
700 LDA &15AA,X:CMP #&3B:BEQ P%+&05:JMP &11CB:JMP &12B7
710 LDA &15AA,X:CMP #&20:BNE P%+&06:INX:JMP &11BE:CMP #&30
720 BCC P%+&3A:CMP #&3A:BCS P%+&36:STY &84:STX &83:JSR &1039
730 LDX &83:LDY &84:LDA #&A0:STA (&7A),Y:INY:LDA &7F:STA (&7A),Y
740 INY:LDA #&A2:STA (&7A),Y:INY:LDA &80:STA (&7A),Y:INY
750 LDA #&20:STA (&7A),Y:INY:LDA &85:STA (&7A),Y:INY:LDA &8B
760 STA (&7A),Y:INY:JSR &1237:JMP &11D2:LDA #&64:STA &1A58
770 STY &1A69:JSR &13CD:LDA &1A23:CMP #&63:BEQ P%-&50:STY &84
780 LDY #&00:LDA &15AA,X:CMP #&20:BEQ P%+&15:STA &1592,Y:INX:INY
790 JMP &1228:LDX &83:INX:LDA &15AA,X:CMP #&20:BNE P%-&06:RTS
800 LDA #&0D:STA &1592,Y:STX &83:JSR &0FAF:LDX &83:LDY #&00
810 JSR &125F:LDA (&81),Y:CMP #&20:BNE P%-&07:JSR &125F
820 JMP &126D:LDA &81:CLC:ADC #&01:STA &81:LDA &82:ADC #&00
830 STA &82:RTS:LDY &84:LDA #&20:STA (&7A),Y:INY:LDA &81
840 STA (&7A),Y:INY:LDA &82:STA (&7A),Y:INY:LDA &86:STA &81
850 LDA &87:STA &82:DEX:DEX:LDA &15AA,X:CMP #&2E:BNE P%+&0D:INX
860 LDA &15AA,X:CMP #&22:BEQ P%+&0A:JMP &129B:INX:INX:JMP &11D2
870 JSR &115D:JMP &11D2:INY:LDA &15AA,X:STA (&7A),Y:CMP #&20
880 BEQ P%+&07:INX:INY:JMP &12A6:INY:NOP:RTS:LDA #&60
890 STA (&7A),Y:INY:TYA:CLC:ADC &7A:STA &7A:LDA &7B:ADC #&00
900 STA &7B:JMP &0E2A:STY &84:LDY #&00:INX:LDA &15AA,X
910 STA (&77),Y:CMP #&20:BEQ P%+&06:INY:JMP &12CF:INY:LDA #&20
920 STA (&77),Y:INY:LDA &1A67:STA (&77),Y:INY:LDA &1A68
930 STA (&77),Y:INY:LDA #&60:STA (&77),Y:INY:INY:INY:STA (&77),Y
940 INY:INY:TYA:CLC:ADC &77:STA &77:LDA &78:ADC #&00:STA &78
950 LDY &84:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP:NOP
960 NOP:RTS:PLA:TAX:PLA:PHA:TAY:TXA:PHA:CLC:ADC #&02:TAX:TYA
970 ADC #&00:LDY &7E:INY:STA &16D6,Y:INY:TXA:STA &16D6,Y:STY &7E
980 RTS:JSR &12CB:RTS:JSR &12CB:PLA:PLA:JMP &0EBD:STX &1A6A:PLA
990 PLA:LDX &7D:LDA #&60:STA &1640,X:LDA #&00:STA &7D:JSR &1640
1000 LDX &1A6A:LDY &1A69:JMP &11D2:LDX #&00:STA &1967:CMP #&00
1010 BEQ P%+&18:LDA &1968,X:CMP #&0D:BEQ P%+&06:INX:JMP &1364
1020 LDY &1967:DEY:STY &1967:TYA:JMP &1360:INX:INX:LDA &1968,X
1030 CMP #&0D:BEQ P%+&08:JSR &FFEE:JMP &137B:JSR &FFE7:LDX &70
1040 TXS:JMP &0E26:LDY &7E:CPY #&02:BCS P%+&07:LDA #&01:JMP &135B
1050 LDA &16D6,Y:STA &15A6:DEY:LDA &16D6,Y:STA &15A7:DEY:STY &7E
1060 RTS:LDY &7E:CPY #&04:BCS P%+&07:LDA #&01:JMP &135B:JSR &139D
1070 LDA &16D6,Y:STA &15A8:DEY:LDA &16D6,Y:STA &15A9:DEY:STY &7E
1080 RTS:STY &84:STX &83:LDY #&00:STY &1A22:LDA &1A24,Y
1090 CMP &15AA,X:BEQ P%+&21:CMP #&0D:BEQ P%+&13:CMP #&20
1100 BNE P%+&0B:LDA &1A22:CLC:ADC #&02:STA &1A22:INY:JMP &13D6
1110 LDX &83:LDY &84:LDA #&00:STA &1A23:RTS:INX:STX &15A6
1120 STY &15A7:INY:LDA &15AA,X:CMP #&20:BEQ P%+&19:CMP &1A24,Y
1130 BNE P%+&06:INX:JMP &1404:LDX &83:LDY &15A7:INY:LDA #&00
1140 STA &1A23:JMP &13D6:LDA &1A24,Y:CMP #&20:BNE P%-&13:STX &83
1150 LDX &1A22:LDA &1A4C,X:STA &8C:INX:LDA &1A4C,X:STA &8D
1160 LDA #&63:STA &1A23:LDY &84:LDX &83:JMP (&008C):LDA &1A5B
1170 STA &15A6:LDA &1A5C:STA &15A7:LDA &1A59:STA &15A8:LDA &1A5A
1180 STA &15A9:JSR &149A:RTS:LDA &1A61:STA &15A6:LDA &1A62
1190 STA &15A7:LDA &1A65:STA &15A8:LDA &1A66:STA &15A9:JSR &149A
1200 RTS:LDA &1A63:STA &15A6:LDA &1A64:STA &15A7:LDA &1A65
1210 STA &15A8:LDA &1A66:STA &15A9:JSR &149A:RTS:LDA &1A58
1220 CMP #&64:BEQ P%+&2A:LDY &7D:LDA &7A:STA &1987:LDA &7B
1230 STA &1988:LDA &1989:STA &7A:LDA &198A:STA &7B:JSR &14C9
1240 STY &7D:LDA &1987:STA &7A:LDA &1988:STA &7B:LDX &83:RTS
1250 LDA #&20:STA (&7A),Y:INY:LDA &15A6:STA (&7A),Y:INY:LDA &15A7
1260 STA (&7A),Y:LDA #&20:INY:STA (&7A),Y:INY:LDA &15A8
1270 STA (&7A),Y:INY:LDA &15A9:STA (&7A),Y:INY:RTS:LDY &7E
1280 LDA &16D6,Y:DEY:STY &7E:CMP #&01:BNE P%+&16:PLA:CLC:ADC #&03
1290 TAX:PLA:ADC #&00:PHA:TXA:PHA:LDX &198B:DEX:DEX:STX &198B:RTS
1300 RTS:LDY &7E:LDA &16D6,Y:STA &15A6:DEY:LDA &16D6,Y:STA &15A7
1310 DEY:STY &7E:LDX &198B:DEX:DEX:DEX:LDA &198C,X:CLC:ADC &15A6
1320 STA &198C,X:INX:LDA &198C,X:ADC &15A7:STA &198C,X:INX:INX
1330 CMP &198C,X:BEQ P%+&07:BCS P%+&13:JMP &1552:DEX:DEX:DEX
1340 LDA &198C,X:INX:INX:CMP &198C,X:BCS P%+&03:RTS:PLA:CLC
1350 ADC #&03:STA &15A6:PLA:ADC #&00:PHA:LDA &15A6:PHA:LDA &198B
1360 SEC:SBC #&06:STA &198B:RTS:LDY &7E:INY:LDA #&00:STA &16D6,Y
1370 INY:LDA #&01:STA &16D6,Y:STY &7E:JMP &150D:LDX &198B:DEX:DEX
1380 DEX:DEX:PLA:PLA:LDA &198C,X:PHA:DEX:LDA &198C,X:PHA:RTS:]
```

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FORTH SPECTRUM

David Millington presents a program to develop Forth on your Spectrum.



THIS VERSION OF the computer language Forth will run on the 48K Spectrum, but because of many of the Poke addresses used, it is not compatible with Microdrives and the Interface 1 operating system.

It consists of two distinct parts; a compiler and editor written in Basic and a set of Forth words in machine code. The main advantage of Forth as a language is its very fast execution speed and this implementation will run typically 50 times faster than Basic.

The speed increase is due to the fact that a Forth program is converted directly into machine code, and the modular nature of Forth makes the process of compilation very easy. Since the compiler in my version is in Basic, it compiles quite slowly, but the code produced will run as fast as commercial Forths.

The theory of simple programming in Forth has been covered in previous issues of *Your Computer*, but I will recap the simple concepts for those who are new to the language. My implementation is mostly standard Forth and includes all the usual structures, but it differs in its use of variables and strings and is less flexible in the methods of defining words. However, it should serve as an introduction to the advantages of the language and can be used for applications such as graphic games as I hope to show in a future article.

Before we can begin to use Forth though there is the daunting task of entering the listings. Figure 1 is the compiler which should be typed in and secured on tape with the command

SAVE "forth" LINE 8500

Special care should be taken with the string handling and Poke statements since any errors will be difficult to trace later causing much frustration. Figure 2 will create the block of machine code word definitions using extensive checksumming, and when the hex data is bug-free, it will Save the machine code on tape after the compiler.

Rewind the tape and type

LOAD "forth"

and both parts of the program will load. You should be presented with the title and after a short pause, a question mark prompt and a flashing blank cursor will appear at the bottom, awaiting your commands.

The main feature of Forth is the stack which is simply a pile of numbers. A number can be added to the top of the stack and later the top number can be removed. These two simple operations are the basis of Forth. You should now type in 23 and press enter, and this number will be placed on top of the stack. If you now type a full stop and enter, the top number on the stack will be removed and printed. The full-stop is an example of a Forth word, many of which do something to the stack as shown. The word + will fetch the top two numbers from the stack, add them together, and place the sum back on top. You should now be able to use Forth to add together two numbers and print the result. One way is to enter

23 45 + .

and the answer 68 will appear. This also illustrates how several items can be entered together separated by spaced. Similarly the words , /, * are available for arithmetic, and complex expressions can be evaluated. Consider the Basic statements

PRINT (5 + 11)/(5 3)

The equivalent in Forth is

5 11 + 5 3 / .

Both will yield the answer 8. If the Forth version seems strange, study figure 3 which details the effect upon the stack as each command is executed. Forth simply requires each operation to be placed after the operands instead of in between, whether they are numbers or other expressions. This is known as postfix notation, and it automatically removes the need for brackets.

You should experiment with various expressions until you are sure what is happening and how the stack is being used. Sooner or later you will discover that Forth

(continued on page 161)

Figure 1

```
   1 REM ************************
   2 REM *FORTH COMPILER/EDITOR*
   3 REM *                      *
   4 REM * © D.MILLINGTON 1983 *
   5 REM ************************
   6 :
   7 :
  50 DEF FN h(a$)=CODE a$-48-(39 AND a$>="a")
 100 LET addr=44016: LET addr1=addr
 105 LET end=addr
 110 LET vars=43000
 120 GO SUB 8000: GO SUB 7000
 130 PRINT AT 21,0;
 140 LET ed=0: LET sp=1: DIM s$(3004)
2000 REM MAIN KEYBOARD LOOP
2090 LET def=0
2100 IF ed THEN RETURN
2102 IF NOT ed THEN POKE 23617,158: INPUT "? "; LINE l$: PRINT l$
2105 IF l$="" THEN GO TO 2102
2107 IF l$(1)="*" AND def=0 THEN GO TO 3000
2108 IF def OR l$(1)=":" THEN LET s$(sp TO )=CHR$ LEN l$+l$: LET sp1=sp: LET sp=sp+LEN l$+1
2110 IF l$(1)=":" THEN GO TO 2500
2120 IF l$(LEN l$)=";" THEN GO TO 2600
2130 IF def THEN GO TO 2700
2200 LET addr=end: GO SUB 5000
2210 POKE addr,201: LET x=USR end: GO TO 2100
2510 LET pos=1: GO SUB 6000: LET w$=w$(2 TO )
2520 LET def=1: LET no=no+1: LET d$(no)=w$: LET a(no)=addr
2530 LET l$=l$(pos+1 TO ): GO TO 2120
2600 IF LEN l$>1 THEN LET l$=l$( TO LEN l$-1): GO SUB 5000
2603 POKE addr,201: LET addr=addr+1: LET end=addr
2605 LET def=0
2610 GO TO 2100
2700 GO SUB 5000: GO TO 2100
3000 REM COMPILER COMMANDS
3010 LET l$=l$(2 TO )
3015 IF l$="list" THEN GO TO 3300
3017 IF l$="del" THEN LET sp=1: LET s$="": GO TO 2100
3020 IF l$( TO 5)="edit " THEN GO TO 3200
3025 IF l$="pr on" THEN OPEN #2,"p": GO TO 2100
3030 IF l$="pr off" THEN CLOSE #2: GO TO 2100
3035 IF l$="dlist" THEN FOR i=1 TO no: PRINT d$(i),a(i): NEXT i: GO TO 2100
3040 IF l$="reset" THEN RUN
3050 IF l$( TO 5)="dsave" THEN LET a(81)=end: LET a(82)=no: SAVE l$(7 TO ) DATA a(): SAVE l$(7 TO ) DATA d$(): SAVE l$(7 TO )CODE 44016,end-44015: GO TO 2100
3055 IF l$( TO 5)="dload" THEN LOAD l$(7 TO ) DATA a(): LET end=a(81): LET no=a(82): LOAD "" DATA d$(): LOAD ""CODE : LET sp=1: LET s$="": GO TO 2100
3060 IF l$( TO 5)="ssave" THEN LET s$(3001 TO )=STR$ sp: SAVE l$(7 TO ) DATA s$(): GO TO 2100
3065 IF l$( TO 5)="sload" THEN LOAD l$(7 TO ) DATA s$(): LET sp=VAL s$(3001 TO ): LET p=1: GO TO 3260
3070 IF l$( TO 5)="msave" THEN SAVE l$(7 TO )CODE 43200,end-43199: GO TO 2100
3100 GO TO 2100
3200 LET a$=l$(6 TO ): LET p=1
3210 IF s$(p+1)=":" THEN GO TO 3220
3215 LET p=p+CODE s$(p)+1: IF p>=sp THEN LET e=1: GO TO 9530
3216 GO TO 3210
3220 IF s$(p+2 TO p+1+LEN a$)<>a$ THEN LET p=p+CODE s$(p)+1: GO TO 3210
3225 LET p1=p
3230 LET e$=s$(p+1 TO p+CODE s$(p)): LET sp=sp-LEN e$: GO SUB 7100: LET sp=sp+LEN e$: LET s$(p TO )=CHR$ LEN e$+e$+s$(p+CODE s$(p)+1 TO )
3235 PRINT e$
3240 IF e$(LEN e$)<>";" THEN LET p=p+LEN e$+1: GO TO 3230
3250 LET w$=a$: FOR i=1 TO no: IF d$(i)<>w$( TO 10) THEN NEXT i: LET e=1: GO TO 9530
3255 LET end=a(no): LET no=i-1: LET p=p1
3260 LET addr=end: LET ed=1
3270 LET l$=s$(p+1 TO p+CODE s$(p))
3280 GO SUB 2110: LET p=p+CODE s$(p)+1: IF p<sp THEN GO TO 3270
3290 LET ed=0: GO TO 2100
3300 LET p=1: PRINT
3310 PRINT s$(p+1 TO p+CODE s$(p)): IF s$(p+CODE s$(p))=";" THEN PRINT
3315 LET p=p+CODE s$(p)+1: IF p<sp THEN GO TO 3310
3320 GO TO 2100
5000 REM COMPILE l$ AT ADDR
5010 LET addr1=addr: DIM w$(32)
5020 IF l$(1)="(" THEN RETURN
5100 LET pos=1: LET last=0
5110 IF last THEN RETURN
5115 GO SUB 6000
5120 IF w$(1)>="0" AND w$(1)<="9" OR w$(1)="-" AND w$(2)<>" " THEN GO TO 5500
5130 IF w$(2)="@" THEN GO TO 5600
5140 IF w$(2)="!" THEN GO TO 5700
5160 IF w$(1)="#" THEN GO TO 5850
5170 IF w$(1)="""" THEN GO TO 5900
5200 FOR i=1 TO no: IF w$( TO 10)<>d$(i) THEN NEXT i: LET e=1: GO TO 9530
5210 POKE addr,205: LET addr=addr+1: LET dd=a(i): GO SUB 6100
5220 GO TO 5110
5505 LET dd=VAL w$: IF dd<0 THEN LET dd=65536+dd
5510 POKE addr,33
5520 LET addr=addr+1: GO SUB 6100
5525 GO SUB 6200
5530 GO TO 5110
5610 LET v=CODE w$-97
5615 IF v<0 OR v>25 THEN LET e=7: GO TO 9530
5620 POKE addr,42: LET addr=addr+1
```

(listing continued on page 161)



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(listing continued from page 159)

```
5630 LET dd=vars+v*2: GO SUB 610
0
5635 GO SUB 6200
5640 GO TO 5110
5710 LET v=CODE w$-97
5715 IF v<0 OR v>25 THEN LET e=7
: GO TO 9530
5720 GO SUB 6250
5730 POKE addr,34: LET addr=addr
+1
5740 LET dd=vars+v*2: GO SUB 610
0
5750 GO TO 5110
5855 LET w$=w$(2 TO )
5860 IF w$(1)=" " THEN GO TO 511
0
5865 POKE addr,FN h(w$(1))*16+FN
 h(w$(2)): LET addr=addr+1
5870 LET w$=w$(3 TO ): GO TO 586
0
5902 POKE addr,33: LET addr=addr
+1: LET dd=addr+7: GO SUB 6100:
GO SUB 6200
5905 POKE addr,24: LET i=2
5910 LET w$=w$(2 TO ): IF w$(1)=
"""" THEN GO TO 5920
5915 POKE addr+i,CODE w$: LET i=
i+1: GO TO 5910
5920 POKE addr+i,13: POKE addr+1
,i-1: LET addr=addr+i+1
5940 GO TO 5110
6000 REM PICK UP NEXT WORD
6005 LET last=0
6010 IF l$(pos)=" " THEN LET pos
=pos+1: GO TO 6010
6015 IF l$(pos)="""" THEN LET po
s=pos+1: GO TO 6040
6020 FOR z=pos TO LEN l$: IF l$(
z)<>" " THEN NEXT z: LET z=z-1:
LET last=1
6030 LET w$=l$(pos TO z): LET po
s=z: RETURN
6040 FOR z=pos TO LEN l$: IF l$(
z)<>"""" THEN NEXT z: LET z=z-1:
 LET last=1
6045 IF z=LEN l$ THEN LET last=1
6050 LET w$=""""+l$(pos TO z): L
ET pos=z+1: RETURN
6100 REM STORE DD AT ADDR
6110 POKE addr,dd-256*INT (dd/25
6)
6120 POKE addr+1,INT (dd/256)
6130 LET addr=addr+2: RETURN
6199 REM STORE A CALL PUSH COMMA
ND
6200 POKE addr,205: LET addr=add
r+1: LET dd=40610+3196: GO SUB 6
100: RETURN
6249 REM STORE A CALL POP COMMAN
D
6250 POKE addr,205: LET addr=add
r+1: LET dd=40622+3196: GO SUB 6
100: RETURN
7000 IF PEEK 43100=229 THEN GO T
O 7090
7010 REM SET UP EDITOR/ERROR TRA
P ROUTINES
7020 RESTORE 7050: FOR i=1 TO 3:
 READ e
7030 READ c: IF c<>-1 THEN POKE
e,c: LET e=e+1: GO TO 7030
7040 NEXT i
7050 DATA 43100,229,42,170,92,12
6,35,34,176,92,225,65,201,-1
7060 DATA 43120,253,200,1,222,20
5,166,30,245,254,7,40,16,254,16,
40,6,254,11,40,2,241,201,241,62,
0,167,201,-1
7070 DATA 43150,50,58,92,50,129,
92,205,176,22,62,255,205,1,22,62
,236,215,62,61,215,195,160,16,24
,231,-1
7080 POKE 23582,11: POKE 23746,9
2: POKE 23747,168
7090 LET e=PEEK 23613+256*PEEK 2
3614: POKE e,142: POKE e+1,168:
LET q=2500
7095 RETURN
7100 REM EDIT E$
7110 LET x=USR 5600: PRINT #4;e$
7115 PRINT #0;"? ";: POKE 23736,
112: POKE 23737,168
7120 POKE 23617,168: POKE 23643,
PEEK 23641: POKE 23644,PEEK 2364
2: LET x=USR 3864
7125 POKE 23728,PEEK 23641: POKE
 23729,PEEK 23642
7130 INPUT #4; LINE e$
7140 RETURN
8000 REM LOAD DICTIONARY ENTRIES
8010 DIM d$(82,10): DIM a(82): R
ESTORE 8090: READ no
8020 FOR i=1 TO no: READ d$(i),a
(i): NEXT i
8030 RETURN
8090 DATA 35
8100 DATA "+",43232,"-",43245,"d
rop",43260,"dup",43264,"*",43276
,"emit",43309,".",43316
8110 DATA "/",43419,"clear",4352
8,"swap",43536,"over",43557,"=",
43576,"<",43583,">",43609
8120 DATA ">",43616,"+",43637,"?
",43648,"!",43658,"@",43672,"key
",43683,"get",43711
8130 DATA "#",43741,"begin",4375
2,"until",43755,"while",43760,"d
o",43780,"loop",43792,"+loop",43
812
8140 DATA "ind",43864,"if",43874
,"else",43885,"then",43890,"repe
at",43949,"allot",43997,"abort",
44014
8500 CLEAR 42999: LOAD "words"CO
DE
8510 PRINT AT 4,0; INVERSE 1;"**
********************************"
;TAB 31;"**             ZX FORTH
         **      © D.MILLINGTON 1
983      **";TAB 31;"************
**********************"
8520 POKE 23658,0: GO TO 100
9499 REM ERROR HANDLING
9500 IF PEEK 23681=16 THEN GO TO
 9999
9510 LET e=PEEK 23613+256*PEEK 2
3614: POKE e,142: POKE e+1,168
9520 LET e=PEEK 23681
9530 PRINT : IF e=256 THEN PRINT
 "Program ABORTed"': GO TO 9550
9532 IF e<>12 AND e<>26 THEN PRI
NT "ERROR-";
9535 RESTORE 9600: FOR i=1 TO 10
: READ x,e$: IF x<>e THEN NEXT i
: GO TO 9550
9540 PRINT e$''
9550 BEEP .1,17
9560 LET addr=addr1: IF ed THEN
LET p=p1: GO TO 3228
9565 IF def THEN LET sp=sp1
9590 GO TO 2100
9600 DATA 1,"Undefined word",2,"
Bad line",5,"Division by zero",7
,"Bad variable",10,"Number out o
f range",11,"Invalid number",12,
"BREAK",14,"Invalid name",19,"In
valid colour code",26,"Tape load
ing ERROR"
9999 CLOSE #2: CLS : PRINT "Exit
 from ZX FORTH"
```

(continued from page 159)

operates only on integers. Try

20 6 / .

and the answer 3 is produced. The range of numbers which can be handled is 32768 to 32767 although any between 32768 and 65535 can be entered and they will be converted to negatives. If you try to enter anything outside this range then the error message 'Number out of range' will appear. A full list of the systems error messages is given in figure 4 for reference.

So far we have done only simple calculations in direct mode and you are probably waiting to try a full program. The main point to realise is that a Forth program bears little resemblance to either Basic or machine code. There are no line numbers and there is no sequential order of instructions that constitute an actual program.

Instead we store instructions by defining words. You have met five words so far and those which you define yourself can be used in exactly the same way. Suppose we wish to define a word called average which will calculate the average of three numbers. Enter

:average + + 3 / .;

There will be a delay while the word is compiled, and then the prompt and cursor will reappear. The syntax for defining a word is a colon followed by the name we wish to use followed by a sequence of operations and terminated with a semicolon. There is no space after the colon or before the semicolon. If you now enter 10 14 3 average then 9, the average of these three numbers will be printed.

The word average is now as much a part of the computer's Forth vocabulary as the built in or 'core' words, and all are stored in an area of memory called the dictionary. You can define further words using both core words and your own, and the idea is to evolve a program consisting of nested word definitions until typically only a single word is needed to execute your program.

This makes program development easier than in Basic since tasks can be subdivided and appropriate words written and tested separately. The importance of the stack becomes apparent since it is used to pass parameters to and from words, as was demonstrated with the word average.

Figure 5 lists and briefly explains most of the Forth words supported. Those already familiar with the language should be able to try some larger programs, but before embarking on anything too adventurous you will need to know how to edit your work in case of errors. Forth is just as prone to program bugs and typing errors as Basic but, like any compiled language, errors take a long time to correct.

There are several commands for editing and using peripherals and these are listed in figure 6. It should be noted that these are not part of the Forth language and are by no means standard in any other Forth systems which instead use screens for editing. To indicate a system command you should begin the line with an asterisk. Enter * edit average and you should find the definition brought to the bottom of the screen just as you first entered

(continued on page 163)

Figure 2

```
   1 REM ***************************
   2 REM *   FORTH MACHINE CODE    *
   3 REM *                         *
   4 REM * © D.MILLINGTON 1983     *
   5 REM ***************************
   6 REM ACKNOWLEDGEMENTS
  David Threlfall July '83 for
  several useful integer
  arithmetic routines;
  Nigel Dore October '83 for
  method of extensively check-
  summing the hex data.
   9:
  10:
 100 DATA "E9FDE9FDE9DDE9DDE92AC[illegible]"
 110 DATA "[illegible]"
 120 DATA "[illegible]"
 130 DATA "[illegible]"
 140 DATA "[illegible]"
 150 DATA "[illegible]"
 160 DATA "[illegible]"
 170 DATA "[illegible]"
 180 DATA "[illegible]"
 190 DATA "[illegible]"
 200 DATA "[illegible]"
 210 DATA "[illegible]"
 220 DATA "[illegible]"
 230 DATA "[illegible]"
 240 DATA "[illegible]"
 250 DATA "[illegible]"
 260 DATA "[illegible]"
 270 DATA "[illegible]"
 280 DATA "[illegible]"
 290 DATA "[illegible]"
 300 DATA "[illegible]"
 310 DATA "[illegible]"
 320 DATA "[illegible]"
 330 DATA "[illegible]"
 340 DATA "[illegible]"
 350 DATA "[illegible]"
 360 DATA "[illegible]"
 370 DATA "[illegible]"
 380 DATA "[illegible]"
 390 DATA "[illegible]"
 400 DATA "[illegible]"
 410 DATA "[illegible]00000000000000000000000000000000"
 500 DATA [illegible]
 510 DATA [illegible]
1000 CLEAR 43199: LET a=43200: D
IM a(32): LET f=0
1010 RESTORE 500: LET c=0: FOR i
=1 TO 32: READ a(i): LET c=c+a(i
)*i: NEXT i: READ v: IF c<>v THE
N PRINT "Error in lines 500 or 5
10": STOP
1020 FOR i=100 TO 410 STEP 10: R
ESTORE i: LET c=0: READ a$
1030 FOR n=1 TO 31 STEP 2: LET l
=CODE a$(n+1): LET h=CODE a$(n)
1040 LET v=(l-48-(l>57)*7)+(h-48
-(h>57)*7)*16: LET c=c+v*((n+1)/
2)
1050 POKE a,v: LET a=a+1: NEXT n
: IF c<>a(i/10-9) THEN PRINT "Er
ror in line ";i: LET f=1
1060 NEXT i
1070 IF f THEN PRINT "Correct mi
stakes and rerun": STOP
1080 SAVE "words"CODE 43200,817
```

Figure 3.

Expression	5	11	+	5	3		
Stack					3		
		11		5	5	2	
	5	5	16	16	16	16	8

(continued from page 161)

it. It can be altered using standard cursor controls and entered when finished. Alter it to

:average + + + 4 / .;

to allow the average of four numbers to be found. On pressing enter you will hear a stange squeek which is an effect of the Sinclair editor being used at high speed. After several seconds the cursor will reappear with the amendment made to average.

In general, the more words you have defined, the longer the delay will be since a lot of recompiling must be done. Every definition you enter is stored in a source code buffer in case editing is required later. The command *list will list ever definition in the buffer. However, if you type *del then the source buffer is cleared and you will be unable to edit average although it can still be used in Forth. This explains why you cannot edit the core words.

There are Save and Load commands for both the source buffer and the Forth dictionary, again described in figure 6. After a *sload command there will be a long delay while the source code is compiled. The command *reset will delete everything and start Forth from the beginning again. If you have a ZX printer then it can be turned on with *pr on, allowing all output to be printed, *pr off will cancel this facility.

Figure 4. Forth compiler error messages.

Undefined word	A word is either undefined in the dictionary or in the case of *edit, the source code of the definition is unavailable.
Bad line	The line entered generally does not make sense. This error may also be produced if you exceed the memory reserved for the compiler.
Bad variable	An illegal variable name has been used.
Division by zero	1 0 / has been attempted, for example.
Number out of range	A number outside the range 32768 to 65535 has been entered.
Invalid number	A number contains a non-numeric character.
BREAK	Break was pressed when using tape, printer or 'scroll ?'
Invalid name	Illegal file name in cassette commands.
Invalid colour code	Same as in Basic.
Tape loading error	Same as in Basic.
Program ABORTed	The word abort has been executed.

After any error message, the line containing the error must be entered again in full. If any error occurs after editing a word, the word will automatically be presented again for editing, starting from the beginning, and you must skip through it by pressing enter, until you reach the offending line.

As stated before, figure 5 contains brief explanations of the more common Forth words. Emit is used for printing single characters, and on the Spectrum it is especially useful since it can handle the usual colour and position control characters. For instance

16 emit 4 emit 42 emit

will print a green star. There are two words which deal with keyboard input, but only at the single character level. Get will wait for a key or shifted key to be pressed, and returns its code on the stack. It will produce the standard key click, and when it is called rapidly, it will allow keys to repeat. The other word is key, and this works like Inkey$ in Basic.

It will return the code of the key which is being pressed, or 0 if none is pressed. There is no implied wait as there is with Get.

There are four words for manipulating the stack and these are illustrated diagramatically in figure 5b. The most useful is dup, as it will duplicate the top number, allowing one copy to be used and the other preserved for later use.

In any computer language, the ability to perform repeated operations using loops, and to make decisions are very important. You may think that the absence of line numbers and Goto will make this difficult but, in fact, Forth provides several useful control words and these allow clearer program structures to be set up than in Basic.

There are direct equivalents of Basic's For-Next statements and these are do and loop. The actual layout of this and the other structures are shown in figure 5. The word ind will place the index counter of the loop on the stack where it can be used.

In standard Forth this word is simply I, but I have altered it to avoid confusion with the variable I. The word +loop will allow steps of other than 1. The following direct lines illustrate how different step sizes and directions are catered for, and should be entered individually:

```
20 1 do ind . loop
1 20 do ind . loop
100 1 do ind. 17 + loop
30 30 do ind . 2 + loop
```

Figure 7 contains the definition of a word called count, which uses a loop to show the speed of Forth. Two points are shown from this listing. A Forth word definition can span several lines providing the : and ; mark the beginning and end, and also comments can be included providing they are on a separate line and surrounded by brackets.

Enter the definition and execute it by typing count, and you should see the numbers from 1 to 10000 being rapidly printed in the top left of the screen. You should also try editing count to see how each line is presented

(continued on page 166)

Figure 5. Summary of main Forth words.

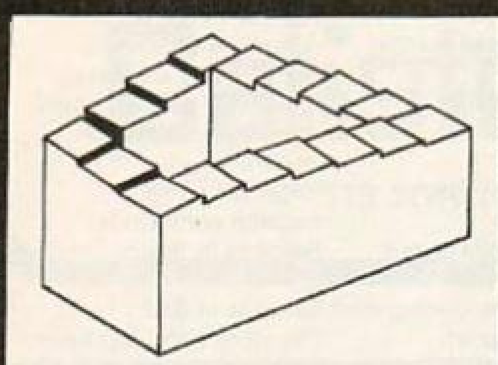
Arithmetic operators:	
+	Add two numbers and place result on stack
	Subtract top number from second number
*	Multiply top two numbers
/	Divide top number into second number. Result is rounded to lowest integer
Input/Output:	
.	Print top number in decimal form
emit	Print character whose code is on stack
get	Wait for a key to be pressed and return its character code
key	return code of key being pressed, or 0 if none
Conditional operators:	
=, <>, <, >	Compare top two numbers according to specified condition, and return 1 if the condition holds, otherwise 0
Stack manipulation: (see Figure 5b)	
drop	Remove top number from stack
dup	Duplicate top number on stack
swap	swap top two numbers around
over	copy second number on stack to the top, over the original top number
Control structures:	

In the following descriptions, the items in brackets refer to any appropriate block of Forth words. All structures can be nested within themselves and others to any level, but all the words at any one level of nesting must be in the same word definition.

(finish) (start) do (code) loop	Perform an indexed loop, with index starting at (start) and counting up or down by one until (finish) is reached. (code) is repeated appropriate number of times.
(finish) (start) do (code) (increment) +loop	Same as previous, except size of increment is specified.
begin (code) (condition) until	(code) is repeated until (condition) gives a true (non zero) value.
begin (condition) while (code) until	(code) is repeated as long as (condition) gives a true value. If (condition) is false the first time, then (code) is skipped altogether.
(condition) if (true code) else (false code) then	If (condition) is true then (true code) is executed, otherwise (false code) is executed. Both parts continue executing after 'then'.
(condition) if (true code) then	Same as previous, except the false condition is not treated separately, and else and the (false code) are omitted.
ind	Place index counter of innermost do loop on stack.
abort	Return to command mode, clearing all nested loops and words.

Figure 5b. Effects of stack operations.

Initial state of stack	dup	drop	swap	over
	30			20
30	30		20	30
20	20	20	30	20
10	10	10	10	10





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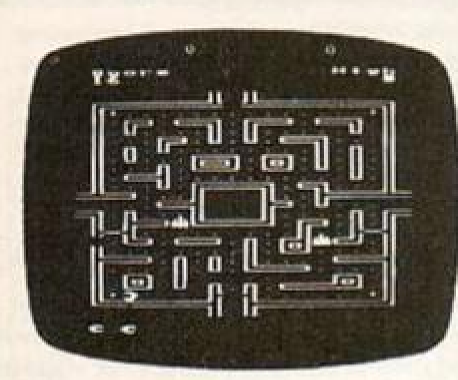
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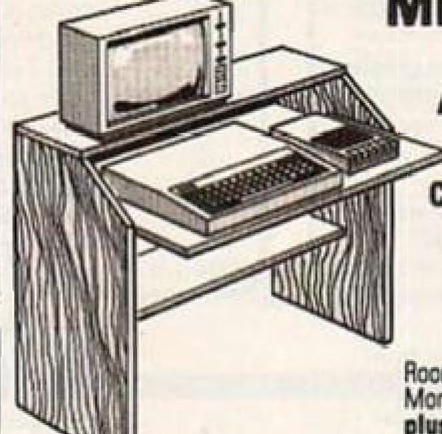
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PIMANIA *"This game can damage your brain." (PersCompGames) "An original and amusing game" (PersCompNews).* **AT PRESS-TIME, YOU CAN STILL WIN THE £6,000 GOLDEN SUNDIAL OF PI** by solving this wonderfully witty adventure. Brilliant use of music and graphics. (Automata) 32K BBC/48K SPECTRUM £10.00.

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(continued from page 163)

separately at the bottom.

In many cases you will need to make decisions or set up a loop which is exited from only when a certain condition is met.

The begin-until loop will allow a block of instructions to be repeated until the condition at the end of the loop is true, and the begin-while-repeat structure will cause looping as long as the condition at the beginning is true. Both these loops will be useful in different circumstances.

The conditions are the results of the oprators <, >, <> and = which all require the two numbers to be compared to be on the stack, and they will return a true value — 1 — or a false value — 0. Until and while both expect such a condition code to be on the stack.

They use this value to decide whether to exit or to continue looping. The following line uses a loop to wait for the a key to be pressed.

begin key 97 = until

The if-else-then structure will allow two different sections of code to be executed depending on whether a condition is true or false, before resuming with the normal flow of execution. The actual layout of these structures is again explained in figure 5.

It must be emphasised that while all of the control structures can be mixed and nested to any depth, they must not cross or be jumped out of other than by a normal exit. Also, all of the loop must be in the same word definition. The word ind will return the index of the inner most do loop, and will only give the correct value if it occurs in the same word definition as the start and finish of the loop.

If you do cross your structures, then a crash is likely. The ease of crashing Forth is a penalty of its high speed and closeness to machine code.

Figure 6. Compiler operating commands.

All command lines must be prefixed with an asterisk.

*edit 'word'	Allows 'word' to be edited one line at a time, if the source code is available, then recopiles 'word' and everything after it.
*list	Lists all word definitions in source code buffer
*del	Clears source code buffer, but leaves Forth dictionary intact.
*reset	Clears everything and restarts Forth.
*dsave 'filename'	Save entire Forth dictionary in three parts
*dload 'filename	Loads dictionary, and clears source code buffer.
*ssave 'filename'	Saves source code buffer on tape.
*sload 'filename	Loads source code buffer and compiles it into dictionary. There will be a long delay while this is done. Note that the filename is NOT placed in quotation marks, and if it is omitted in a load command, then the first file found will be loaded.
*pr on	Sends all further output to ZX printer.
*pr off	Uses screen again for output.
*dlist	Lists contents of dictionary, and the address of the machine code routine for each word.
*msave	Saves Forth program as an independent machine code routine.

You can place the following instructions in a loop if you think that it might not exit:

key 32 = if abort then

Pressing the space key will stop the program with no ill effects, and the message

Program ABORTed

will appear. Abort is the one word which will safely stop execution and jump out of all the nested loops and words.

The rest of figure 7 shows some example of word definitions to illustrate different aspects of simple programming. Type will allow you to enter a line of text onto the screen, terminated by enter. It shows a begin-until loop in action, and also illustrates the use of Get. Fill is a simple utility to fill the screen with the character of your choice. For example

35 fill

will fill the screen with hash signs. This may be slightly slower than you expected, but this is due to the slowness of Sinclair's print routine.

The next word, square, will calculate and print the square of the number on the stack. It is called by the final word, squares, which will print a formatted table of square numbers upto any specified value. When you have entered all these definitions, you may like to Save them on tape, to try out the cassette commands.

It is important that you should experiment with Forth and the facilities of the compiler.

A sheet of special techniques such as error trapping is available for 75p, and also I can supply a cassette of the Forth language and several Forth programs for £3.50. Both are available form D Millington, 13 Willow Crescent, Padgate, Warrington, Cheshire.

Figure 7

```
*list

:count 10000 1 do
(set up the loop)
22 emit 0 emit 0 emit
(move print pos. to top left)
ind .
(print the loop index)
loop;

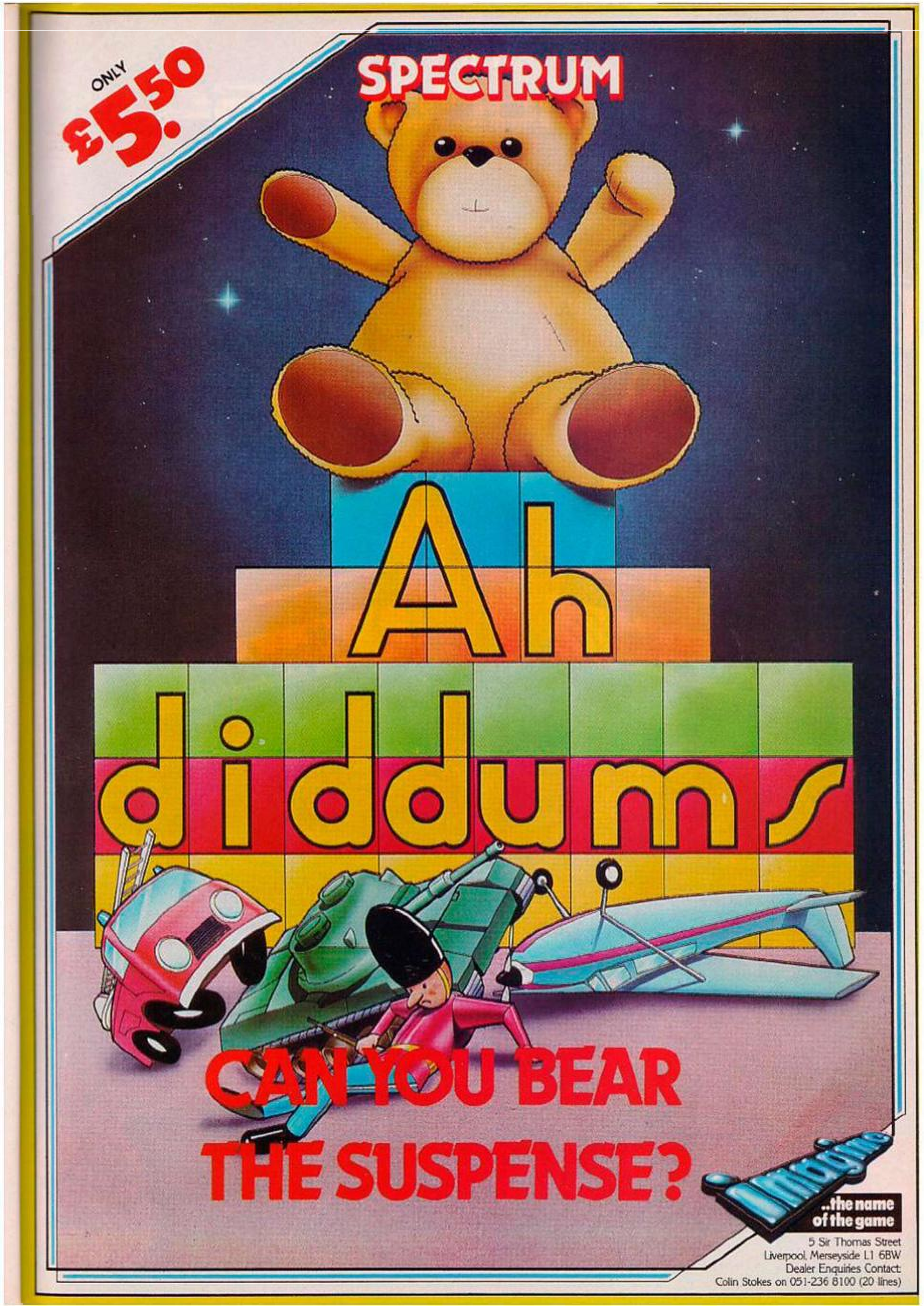
:type begin
(set up loop)
get dup
(get a character from the keyboa
rd and make another copy on  the
 stack)
emit
(print the character)
13 = until
(continue with the loop until th
e character is enter-code 13)
;

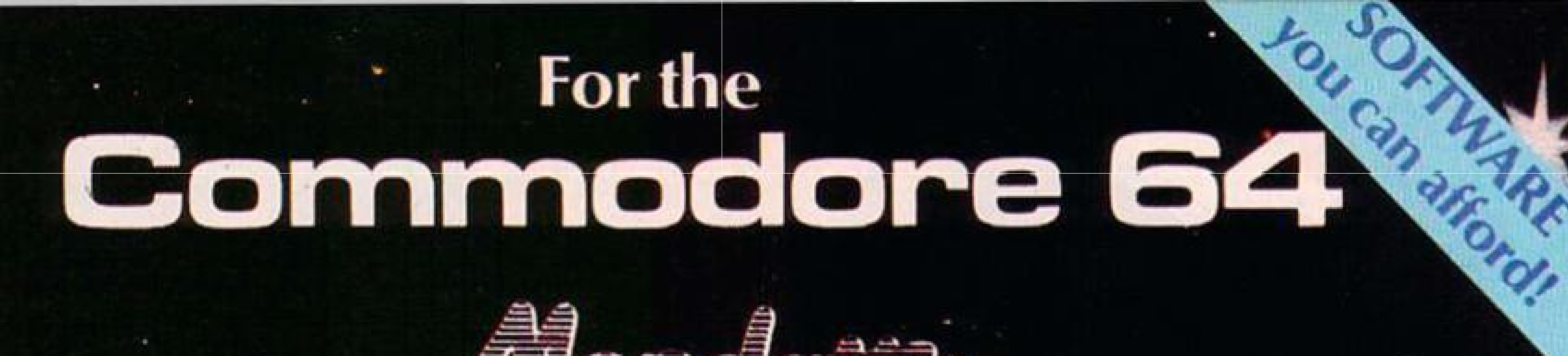
:fill (the code of a character i
s already on the stack)
22 emit 0 emit 0 emit
704 1 do
(set up loop)
dup emit
(duplicate the character on the
stack and print the top copy)
loop
drop
(the character is removed from t
he stack)
;

:square dup * .
(print the square of the number
on the stack)
;

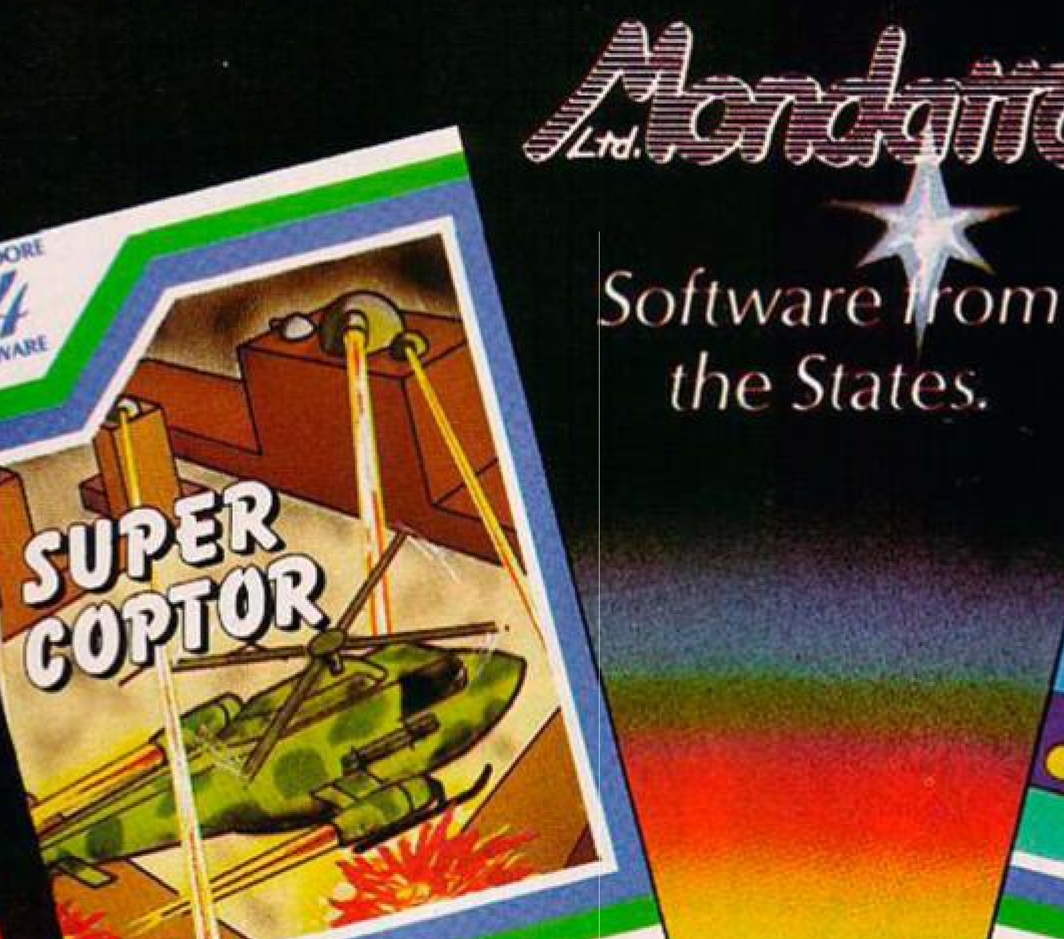
:squares 1 do
(the upper limit of the loop is
already on the stack)
ind .
(print the number) .
6 emit
(this is a COMMA control charact
er)
ind square
(calculate the square using the
previous word we defined)
13 emit
(print on a new line)
loop;

20 squares
1               1
2               4
3               9
4               16
5               25
6               36
7               49
8               64
9               81
10              100
11              121
12              144
13              169
14              196
15              225
16              256
17              289
18              324
19              361
20              400
```


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SLAGTHORPE MEMORIAL Hospital is an Ordinary District General Hospital — DGH — somewhere in the North of England. Like all DGHs, it accepts patients from the doctors working in primary care — general practitioners or family doctors — in the surrounding countryside. It has an Accident and Emergency department — A&E — and a number of wards.

The A&E department has been added recently because I forgot to include it in the original hospital plan procedure. Heartstop is a game where you are asked, as a weekend locum doctor, to look after the patients in the hospital, curing and healing from dawn to dusk and beyond.

Figure 1 is a partial listing of Heartstop to its present stage of construction. I have not included the whole program as much of it remains unchanged from the listing in *Your Computer* — November '83. The complete program and a cassette version will be available at the end of this series.

Last month I wrote enthusiastically about Roy Atherton's book *Structured Programming with BBC Basic.* At one stage he writes:

"It is not easy to reproduce exactly, mistakes and all, every thought and decision on the way to completing a non-trivial program". How true; the slick presentation of a completed program, accompanied by the tedious macho utterance "it was nothing really", is unlikely to help anyone who is attempting to learn about the solution of problems using a computer. In his book he asks:

"Does the package work, week after week, year after year, reliably? Can it work when used by non specialists? Is it sufficiently well documented to enable anyone to take over maintenance or updating should the originator leave? Is the planning, analysis, program design and coding of such a quality that someone else would find it easy to work on? Have details been published or assessed by competent reviewers not otherwise connected with the project?"

Developing reliable software to the standards suggested by Roy Atherton is not easy.

The sort of small bug that causes alarm and despondency at the end of program development is illustrated by the PROCdisplaytime procedure in Figure 1. Line 20 20 originally read:

```
2020 AA% = AA%+1; TIME = 0
```

The purpose of lines 2010 and 2020 is to change the day index — AA% — from Friday to Saturday, or from Saturday to Sunday, when the game clock reaches midnight — 24:00:00. At the same time I intended that the variable Time, used by BBC Basic to store the internal clock count, should be reset to zero to start counting the seconds of a new day.

Unfortunately, I forgot that I want to use the procedure PROCaddtime to advance the game time according to how long it takes to examine a patient, read an ECG or move to another ward. The game might well go a couple of hours past midnight in one bound, only to be reset when the time is displayed.

A correct answer is to subtract the number of seconds in a day from time. However, line 2020 is still wrong and will eventually read:

```
2020 AA% = AA%+1: TIME = TIME -
(360000*24)
```

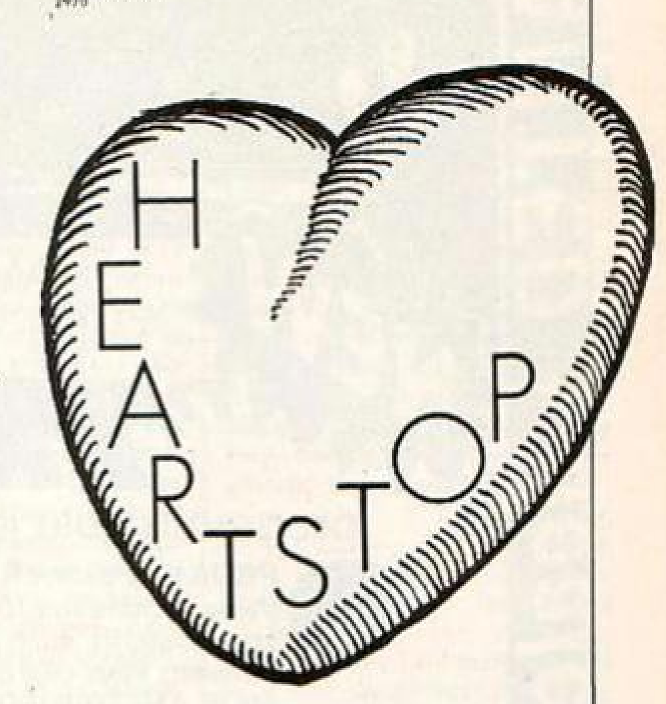
The brackets are not strictly necessary but make the line easier to understand. The program step in the second instruction in the

(continued on page 171)



Figure 1. Partial program for Heartstop.

```
1970
1980 DEF PROCdisplaytime (XX%,YY%)
1990 IF TI% > TIME THEN ENDPROC
2000 TI% = TIME+100
2010 IF (TIME DIV 360000) < 24 THEN 2030
2020 AA% = AA%+1: TIME = TIME - 360000
2030 Sec = (TIME DIV 100) MOD 60
2040 IF Sec = 0 THEN PRINT TAB(XX%,YY%) STRING$(20," ");
2050 Min = (TIME DIV 6000) MOD 60
2060 Hrs = (TIME DIV 360000) MOD 24
2070 PRINT TAB(XX%,YY%);Date$(AA%);" ";Hrs;":";Min;":";Sec;
2080 ENDPROC
2090
2100 DEF PROCdoctor
2110 VDU19,0,6,0,0,0
2120 VDU19,1,1,0,0,0
2130 VDU28,5,31,39,0
2140 VDU30
2150 PRINT TAB(0,6) "What do you want to do next?"
2160 PRINT TAB(0,8) "You may carry out any of the "
2170 PRINT"following actions:"
2180 PRINTTAB(0,11) "A  Move to a new location"
2190 PRINT"B  Talk to & examine a patient"
2200 PRINT"C  X-ray a patient"
2210 PRINT"D  Order an ECG"
2220 PRINT"E  Prescribe drugs"
2230 PRINT"F  Make a diagnosis"
2240 PRINT"G  Talk to the relatives"
2250 PRINT"H  Send a patient home"
2260 PRINT"I  Revise your diagnosis"
2270 PRINT"J  Change the treatment"
2280 PRINT"K  Sign a death certificate"
2290 PRINTTAB(0,26) "Select A - K  "
2300 ENDPROC
2310
2320 DEF PROCD (TX,TY)
2330 REPEAT DO = INKEY(-74)
2340   PROCdisplaytime (TX,TY)
2350   UNTIL DO
2360 ENDPROC
2370
2380 DEF PROCaddtime (AD)
2390 TIME = TIME + AD*6000
2400 ENDPROC
2410
2420 DEF PROCmakepatient
2430 DATA John,Fred,Thomas,Sam,Bertrand,Kevin,
Michael,Bill,Charles,Jack
2440 DATA Roger,Christopher,Jeremy,Andy,Ron
2450 DATA Julia,Mary,Elizabeth,Kate,Anne,Sharon,
Milly,Jacqueline,Alison
2460 DATA Marjorie,Sarah,Meriel,Florence,Briony
2470 DATA Major,Dessett,Newton,Smith,Jones,Kent,
Burton,Crosthwaite,Shaw,Woods
2480 DATA Furlong,Palmer,Campbell,Gilliat,Cratchet,
Charlbury,Appleby,Owen
2490 DATA Hoffenberg,Black,Munro,Rees,Stevenson,
Hewitt,Hunt,Blythe,Cartwright
2500 DATA Delaware,Leighton,Mann,Russell,Robinson,
Sanders,Scroggie,Barron
2510 PT = PT + 1
2520 SEX = RND(2)
2530 IF SEX = FEMALE THEN SEX$ = "F" ELSE SEX$ = "M"
2540 AGE = RND(80)+15
2550 AGE$ = STR$(AGE)
2560 COND$ = "C"
2570 TREAT$ = "T"
2580 IF SEX = FEMALE THEN RESTORE 2450 ELSE RESTORE 2430
2590 NN = RND(14)
2600 FOR NN1 = 1 TO NN
2610   READ firstname$
2620   NEXT NN1
2630 RESTORE 2470
2640 NN = RND(34)
2650 FOR NN1 = 1 TO NN
2660   READ lastname$
2670   NEXT NN1
2680 MI$(PT) = AGE$ + SEX$ + COND$ + TREAT$ + " " +
firstname$ + " " + lastname$
2690 ENDPROC
2700
2710 DEF PROCconsult
2720 CLS
2730 @% = &00000202
2740 PRINT TAB(0,4) "SLAGTHORPE MEMORIAL HOSPITAL""""Current
In-patients:""
2750 FOR SD = 1 TO PT
2755   NAME = LEN(MI$(SD))-5
2760   PRINT SD;"  ";RIGHT$(MI$(SD),NAME)
2770   NEXT SD
2780 PRINT TAB(0,25) "Press 0 to print this list"
2790 INPUT TAB(0,27) "Which patient do you""
"want to examine?" SD1
2800 IF SD1 <> 0 THEN 2960
2810 *FX5,1
2820 *FX6,0
2830 VDU2
2840 VDU21
2850 PRINT "            SLAGTHORPE MEMORIAL HOSPITAL""
"          MANAGEMENT INFORMATION SERVICE""
2860 PRINT Date$(AA%);" ";Hrs;" ";Min;" ";Sec;" - Current
In-patients"
2870 PRINT ""
2880 FOR Z1 = 1 TO PT
2885   NAME = LEN(MI$(Z1))-5
2890   PRINT Z1;"    ";RIGHT$(MI$(Z1),NAME)
2900   NEXT Z1
2910 PRINT '''"END OF REPORT"
2920 VDU6
2930 VDU3
2940 @% = 10
2950 EXIT = TRUE
2960 ENDPROC
2970
```



(continued from page 169)

line is quite difficult to test because it is only incorrect in some circumstances. If there is no activity in the hospital at midnight and the BBC internal clock ticks past the hour undisturbed then the original statement would have been quite adequate.

When you have to deal with the range of time necessary to complete some activity, however, program testing becomes more difficult. For example, it takes perhaps 30 to 100 minutes to examine a patient and I expect that the line:

```
PROCaddtime (RND(70) + 30)
```

will do what I want at the end of the patient consultation routine, but adding a random number to the Time variable would have made the effects of the PROCdisplaytime mistake unpredictable and hard to check.

A DGH may serve a population of anywhere between 50,000 and 200,000 people. Clearly it will be impossible to provide Heartstop with a representative model of such a community. Family relationships, the geography of the hospital catchment area, housing conditions, types of local industry and cultural variations will all contribute to the patterns of disease in a population.

Patients must be provided for the game both at the beginning and at random intervals throughout the weekend. PROCmakepatient — lines 2420 to 2690 — is the start of this function. It is of central importance to the whole game as the record for each patient determines and records the doctor's work.

The master index array MI$ is dimensioned in PROCinit at the start of the game using the following lines:

```
beds = 20
DIM MI$(beds)
```

to reflect the maximum number of in-patients at any one time. Despite the NHS cuts it is still considered good practice to try and give each patient a bed of their own. At present it is a single dimension array holding the information shown in line 2680.

The variable PT, line 2510, is also very important as it records the number of patients in the hospital. The sex and age of the patient are chosen by lines 2520 to 2550 and then the first and last names are obtained from the data stored at the beginning of the procedure. The 'make patient' procedure will also have to generate a disease and some presenting symptons and signs and these will probably take up one or two more dimensions to the master index array.

The current state of the patient will be stored in COND$ and this will tell you whether the patient's condition is stable, improving or deteriorating. Unlike the disease, which must be kept secret until it is diagnosed by the doctor, the condition is open information that can be accessed at any time.

PROCmakepatient can be used as a general purpose section of code that will create people for all sorts of purposes. The first and last names for the person are attached to a number of attributes such as age and sex, and these can be varied to fit the needs of whatever program the procedure is built into. The procedure could just as well produce a sum of money to be given to players at the start of a game in which you play pontoon against fictional characters made up by the computer.

Figure 2. Slagthorpe Memorial Hospital Management Information Service.

Friday 18 0 2 – Current In-patients
1 Christopher Sanders
2 Florence Rees
3 Thomas Shaw
4 Alison Woods
5 Meriel Campbell
6 Mary Cartwright
END OF REPORT

Friday 19 15 16 – Current In-patients
1 Kate Smith
2 Charles Appleby
3 Jacqueline Major
4 Roger Crosthwaite
5 Briony Rees
6 Charles Palmer
END OF REPORT

Friday 18 0 3 – Current In-patients
1 Mary Shaw
2 Roger Mann
3 Julia Black
4 Sam Major
5 Christopher Russell
6 Alison Appleby
END OF REPORT

PROCconsult is the start of the function "Talk to and examine a patient" displayed in PROCdoctor — lines 2100 to 2300. As it stands at the moment the fixed length information about the age, sex, condition and treatment of the patient is stripped off by line 2755 before the patient's name is printed in line 2760.

Line 2730 changes the format in which numbers are printed to stop the patient number from occupying the first 10 columns of the screen. Line 2940 restores the normal format before the procedure ends. If you press zero when the current in-patients are displayed, a printed 'Management Information Report' is produced. I was quite unable to find a way of turning lines 2810 to 2930 into procedure. I would like to use a similar set of instructions to produce a printed list of bleep messages.

I cannot pass the name of the MI$ array into the procedure without generating an error message. Figure 2 shows the format of the report. Three reports were printed to show how the 'makepatient' procedure fills up the hospital beds that are occupied at the start of the game. The names in the data lists are combined successfully to generate different patients for each new game.

The creation of new patients when the game is run raises a further problem. What happens when a parent says that it is bedtime and means it, or the 'phone rings and you have to set out on an emergency night visit to a real patient. Many games that take more than a few minutes to complete offer a way to Save the current state of the game on tape or disc. Placing isolated variables and strings on to tape by one is inefficient and no fun. Before the program gets unmanageably large I shall want to rationalise the variables into a smaller number of arrays so that the data for the whole program can be read on to tape using a simple loop construction. ■



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1. PRO-LINK allows 9 different functions to be programmed into the joystick, these include the four directional movements, fire, and even the ability for combinations such as: fire & up, fire & down, etc. This means that 9 different keys can be simulated from the joystick at the same time! (Great for PLANETOID). Diagonal movement is also provided if normally allowed for in the game.
2. The PRO-LINK package contains two parts, the hardware adapter used to connect an ATARI style joystick to the user port and a cassette containing software which allows the use of the above joystick with existing games. The hardware adapter, when connected to the B.B.C. user port, will accept ATARI, COMMODORE, GRANDSTAND, LE STICK, SPECTRAVISION (QUICKSHOT), and any other ATARI compatible joysticks.
EXamples of PRO-LINK compatible games:
ACORNSOFT -ALL GAMES INCLUDING: PLANETOID, MONSTERS, SNOOKER, SNAPPER, ROCKET RAID
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RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

BREAK DISABLE

I wish to give copies of my Spectrum programs to my friends — and perhaps, in due course, sell them. I wish to make it so that my friends cannot see my program. Can I disable the Break key?

Alan Purchard, Dunfermline, Fife.

IT IS POSSIBLE to make the computer crash if an error — such as "Break" — is generated. The program should have been Saved with Line — i.e., authorstart — then the first program line should alter the item on the machine stack to be used as the error return — see Sinclair manual page 174 under sysvar 23623, ERR SP. This contains the address of the two bytes to be Poked to change the address — either make it point to an infinite machine-code loop or point to address 0, so that the program self-destructs upon attempting to Break out to Stop from an Input.

This, unfortunately, falls down with cassettes in two ways. Merge will foil this autostart. As well, if the Break out before loading is complete, you can get a sizeable chunk of the Basic program, although it is incomplete since the Spectrum does not do a New on an incomplete load as the ZX-81 did.

● *Answer supplied by Dilwyn Jones.*

INPUT PROBLEM

I own a Sharp MZ-80A and after several months of dabbling with Basic would like to progress onto machine code. I hope this will help me overcome a problem I have with the computer concerning the Input statement. I have written a program that requires a word to be entered up to a maximum of 15 letters. However, if a nul string is returned — i.e., CR or ENT — then the input prompt moves down to the first print position of the next line, and waits for the input again. This completely ruins the screen display. Is there any way that the Input command can be error-trapped so that a nul string is ignored?

J H Weaver, RAF Gutersloh.

JEREMY RUSTON SUGGESTS the following lines should help:

```
1000 A$=""
1010 GET B$
1020 IF B$=CHR$(B) THEN RETURN
1030 A$=A$+B$
1040 IF LEN(A$)=15 THEN RETURN
1050 GOTO 1010
```

The book *Software Secrets, Input, Output and Data Storage Techniques* by Graham Beech (Sigma Technical Press) was written mainly for the MZ-80K and a great deal of the information should help you in developing programming and simple machine-code skills.

SPECTRUM LOGO?

I have heard a lot about the programming language Logo, and want to be able to learn it on my 16K Spectrum. Where can I get Logo for the Spectrum, and how can I learn more about it?

Simon Shaw, London EC2.

YOU CAN GET Logo for many computers — including the TI-99/4A, the Commodore 64, the Apple IIe, the Research 380Z, the Tandy Colour Computer, the IBM PC, and the Atari range, among others. However, at the time of writing, Logo is not available for the Spectrum. Both Sinclair Research and Acorn — who do not support the language for the BBC or the Electron, although privately-produced Logo versions are available — have come in for heavy criticism for not putting their weight behind the language. Sinclair at the moment seems to be favouring Prolog. I have been unable to locate a Logo for the Spectrum.

There are many books which will help you learn about this fascinating language. The most important is *Mindstorms*, written by Seymour Papert, the inventor of Logo. It is available for £4.95, and published by Harvester Press. A paperback version from Fontana is expected shortly. Addison-Wesley's *Logo Programming*, by Peter Ross (£7.95) is also very good. *Discovering Apple Logo*, David D Thornburg, also published by Addison-Wesley (£9.95), is a useful introduction, which is not limited to those who own Apples.

IN SCANNING

In the October issue of Your Computer I gave a reply to C Bradley about the use of In for keyboard scanning in multi-player games. I quoted from the book Delving Deeper into your ZX Spectrum by Dilwyn Jones. Dilwyn has since been in touch with me regarding the answer. He points out that keyboard scanning with In on issue-three Spectrums — the most recent — may not be as simple as I indicated it was in earlier issue machines.

If you are used to 255 meaning no key pressed, that may not be true any more. As Sinclair Research says, you should only check the lower five bits — bits 0 to 4 — of the keyboard ports.

Bit masks are not feasible in Sinclair Basic, so this is what Dilwyn suggests could be done. In Delving Deeper, a method of resolving the ATTR components was suggested. Use this to mask the bits:

```
LET value =IN port number:LET value=value-(INT(value/32*32)
```

A LONG WAIT

Since Christmas 1982 I have been waiting for the Acorn Electron to appear. I first heard about it from your magazine in December 1982. I realised this was the computer for me. I had the money, so all I had to do was wait. To pas the time, I began to learn BBC Basic as I heard the Electron ran it. I have more or less got the hang of it, but it is very frustrating being able to program and not having a computer. Could you please tell me when it is going to appear?

Nigel Johnson, Ripley, Derbyshire.

IN THE ARTICLE called *User's Column* in *Byte* magazine, Jerry Pournell often talks about the "Coming Real Soon" syndrome. He suggests, and I concur, that you should never make purchasing decisions in the computer field in terms of things which will be available shortly. "Shortly" nearly always, as in this case, means longly. You are right, however, to learn BBC Basic as much of it — with the major exception of the Teletext Mode 7 — is applicable to the Electron. You have a single touch entry system for keywords as on the Spectrum, or you can type in words in full, as you choose. The Electron should be widely available by the time you read this reply.

BUY AMERICAN

I am a foreign student currently studying here in Britain. I am planning to buy a TI-99/4A computer to take back to the Philippines next year. However, the TV system in the Philippines is different from the British one. It is the same as the American system? What should I do?

Kenneth Cheng, Cambridge.

I SUGGEST YOU should buy an American machine, thus sidestepping the very real problems inherent in converting the British output to work on your own TV system. You should get hold of an American computing magazine and write to one of the computer mail order companies. I would write before sending money to make sure they are willing to supply you over here.

CLEAR PICTURE

I am a complete novice in microcomputing and I have just bought a ZX Spectrum 48K. My problem is that I can not get a good clear image on my colour TV screen. The image I get is like a TV station which is not tuned in correctly. It is fuzzy, unclear, and with a slight ghosting. I have a Grundig Super Colour Teletext TV set and I have tuned it to channel 36 as per the Spectrum instruction book. In fact, I have been through all the channels to see if I can find a better one. I get a good clear image on the black and white portable that I have, but I can not get the same results on my colour set. I have tried changing the Border, Paper and Ink colours as well, without any improvement. I would be grateful if you could help.

W Wabe, Newton, Nottingham.

YOUR TELEVISION set should work perfectly with the Spectrum. Although there have been problems with some cheaper brands of colour TV, your set is a very high standard one indeed and should produce a very good picture. It sounds to me as if you haven't tried the fine tuning. The reference to channel 36 is only an indication. You are expected to adjust the channel tuning slightly until the picture improves. The picture will never be as perfect as one produced by a good television signal, but later model Spectrums — such as yours — produce far more steady displays than some of the earlier ones.

HOT ZX-81

Response Frame has received a number of letters regarding ZX-81's failing when they get hot. Eric Curling, from Tilehurst, Reading, has had this experience, and suggests some ways to improve matters:

"For about a year now, my ZX-81 with 16K has had an infuriating habit of locking up after about an hour of use.

"The display remained. However, the keyboard became disabled. I spoke to Sinclair several times, and the company kindly sent me some new chips — ROM and ULA. I replaced these, and within an hour the keyboard locked up again.

"In despair I went out and purchased a Spectrum which satisfied my fingers for a while. However, I still had a use for my ZX-81 and decided to retrieve it from the dustbin. I remembered reading an article about the way the internal 1K of RAM was disabled when the 16K RAM was fitted. I noticed that the address bus remains unbuffered and connected to the 2x2114 chips.

"When the 16K RAMpack was connected, I decided that removal of the surplus chips would be a good idea, just in case they were getting in the way. Hey presto! I can now Enter and Run very long programs, without a hint of keyboard lockup."

SOFTWARE FILE

Software File gives you the opportunity to have your programs, ideas and discoveries published. We will accept contributions for any home computer provided they are submitted to *Your Computer* exclusively. Please double-check your programs and specify the memory they require before sending them, preferably on cassette. We pay between £6 and £36 for contributions published.

Doom Church

Mark Bristow,
St Peter Port,
Guernsey.



YOU PLAY THE part of Charlie the church carpenter. The idea is to build the church tower before the "thing" on the roof moves across to the end, and also without being hit by the demolition ball.

To do this you must collect a ladder from the right and take it to scaffolding on the left. When you have built all four ladders up, you must go to the top and release the tower.

Once this is done the "thing" on the roof stops moving. But you still have to place the clock in the right place on top of the church.

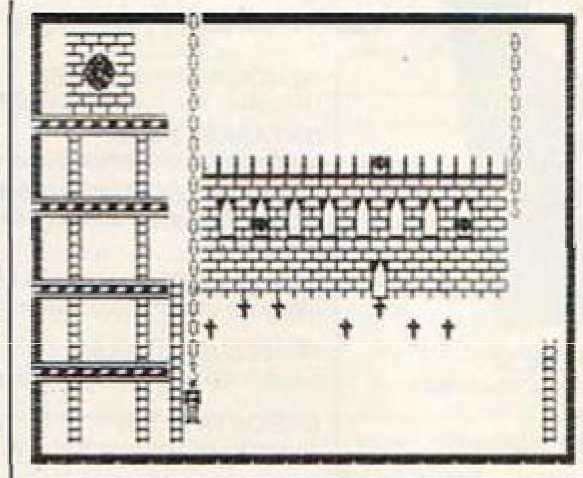
This is simply done by pressing 0 when you think it is over the right place on the church.

Use the graphics machine-code loader to enter data for the user graphics. Then type in the main program. Save the main program and code for graphics by entering Goto 9000. Then rewind tape and press play to Verify it.

In lines 220, 1050, 2040 and 5000 the inverse letters should simply be typed in as normal letters, but the normal looking letters should be typed in as the graphics of those letters.

Program notes.

Lines 10 to 75 print initial screen display.
Line 80 sets up variables.
Line 90 waits for keypress and sets up loop for number of ladders.
Line 100 prints new position of Charlie and demolition ball.
Line 102 checks if Charlie has been hit.
Line 103 checks if Charlie has climbed up to clock.
Lines 105 to 130 move demolition ball.
Line 140 picks ladder up, then decreases loop containing number of ladders.
Line 150 puts ladder down if you are in the right place and if you are carrying a ladder.
Line 200 moves Charlie horizontally depending on keypress.
Line 210 moves Charlie vertically depending on keypress and where he is.
Line 215 moves the thing on the church across depending on time.
Line 220 increases time and checks to see if time is up.
Line 230 prints thing on the church.
Line 490 prints thing in one of the windows of the church.
Line 500 Goto 100.
Lines 1000 to 1050 you are hanged.
Lines 2000 to 2030 move clock across checks, and to see if 0 is pressed to release clock.
Line 2040 checks if clock is in right place.
Lines 2050 to 2080 church tower built.
Lines 5000 to 5050 give final assessment and ask for another go.
Lines 9000 to 9010 Saves and Verifies a copy of Doom Church.
Line 9050 where program auto Runs from.



Machine code for graphics.

```
"A" -,255,0,255,15,15,255,0,255
"B" -,66,66,126,66,66,66,126,66
"C" -,56,56,16,238,254,198,222,222
"D" -,198,124,60,84,84,84,84,238
"E" -,56,100,226,242,250,124,56,0
"F" -,3,14,30,59,127,111,254,158
"G" -,128,224,240,184,188,108,254,242
"H" -,254,111,127,59,30,14,3,0
"I" -,126,156,226,184,240,224,128,0
"J" -,255,1,1,1,255,16,16,16
"K" -,24,36,36,36,36,36,24,0
"L" -,24,36,24,16,8,4,36,24
"M" -,56,124,250,242,226,100,56,0
"N" -,189,255,219,255,189,153,129,255
"O" -,129,129,129,129,129,129,129,255
"P" -,255,231,231,195,195,129,129,129
"Q" -,24,24,126,126,24,24,24,24
```



Graphics machine-code loader

```
  10 LET total=0: FOR n=USR "a" TO USR "q"+7
  20 INPUT "    CODE :--> ";code
  30 PRINT n,code
  40 POKE n,code
  45 LET total=total+PEEK n
  50 NEXT n
  60 CLS : PRINT AT 10,10;("*** OK ***" AND total=15893);("*** ERROR IN DATA ***" AND total<>15893)
```

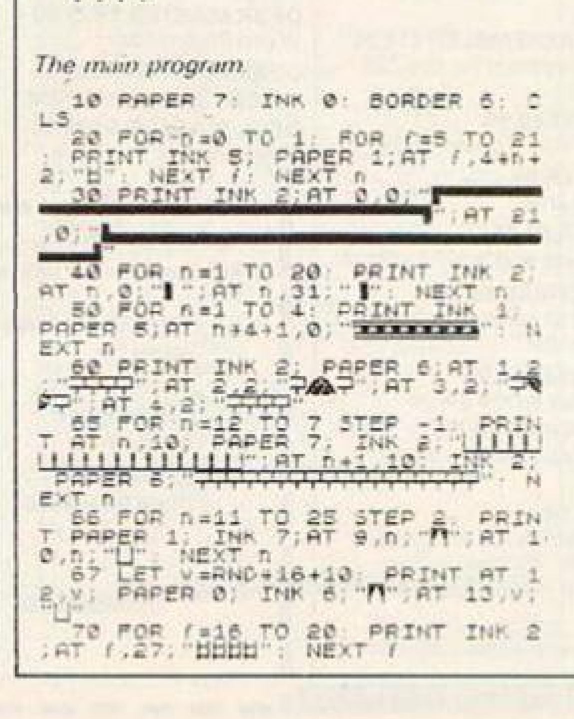
The graphics.

A	– ☰	J	– ⊤
B	– ╫	K	– 0
C	– (Charlie head)	L	– $
D	– (Charlie legs)	M	– ●
E	– ●	N	– ▦
F	– ◢	O	– ⊔
G	– ◣	P	– ∏
H	– ◥	Q	– †
I	– ◤		

– Charlie

● – Demolition ball

– Church clock



The main program.

```
  10 PAPER 7: INK 0: BORDER 6: CLS
  20 FOR n=0 TO 1: FOR f=5 TO 21: PRINT INK 5; PAPER 1;AT f,4*n+2;"B": NEXT f: NEXT n
  30 PRINT INK 2;AT 0,0;"▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀";AT 21,0;"▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄▄"
  40 FOR n=1 TO 20: PRINT INK 2;AT n,0;"▌";AT n,31;"▐": NEXT n
  50 FOR n=1 TO 4: PRINT INK 1; PAPER 5;AT n*4+1,0;"AAAAAA": NEXT n
  60 PRINT INK 2; PAPER 6;AT 1,2;"JJJJ";AT 2,2;"JGFJ";AT 3,2;"JHIJ";AT 4,2;"JJJJ"
  65 FOR n=12 TO 7 STEP -1: PRINT AT n,10; PAPER 7; INK 2;"QQQQQQQQQQQQQQQQQQQQ";AT n+1,10; INK 2; PAPER 6;"JJJJJJJJJJJJJJJJJJJJ": NEXT n
  66 FOR n=11 TO 25 STEP 2: PRINT PAPER 1; INK 7;AT 9,n;"P";AT 10,n;"O": NEXT n
  67 LET v=RND*16+10: PRINT AT 12,v; PAPER 0; INK 6;"P";AT 13,v;"O"
  70 FOR f=16 TO 20: PRINT INK 2;AT f,27;"BBBB": NEXT f
```



```
  75 FOR n=1 TO 8: PRINT INK 1;AT n,28;"K";AT 9,28;"L";AT 15+INT (RND*3)-1,2*n+8;"Q": NEXT n: PRINT INK 1;AT 13,8;"QQ"
  80 LET o=19: LET p=13: LET x=10: LET y=28: LET x1=-1: LET y1=1: LET time=0: LET a=x: LET b=y: LET c=o: LET d=p
  90 PAUSE 0: LET ladder=0: FOR n=4 TO 0 STEP -1: LET dist=4*n+3
 100 LET v=INT (RND*8)*2+11: PRINT AT a,b;" ";AT c,d;" ";AT c+1,d;" ";AT o,p;"C";AT o+1,p;"D": PRINT INK 1;AT x,y;"E"; INK 7; PAPER 1;AT 10,v;"N": LET c=o: LET d=p: LET a=x: LET b=y
 102 IF ATTR (o,p)<>56 OR ATTR (o+1,p)<>56 THEN GO TO 1000
 103 IF o=3 AND p=6 THEN GO TO 2000
 105 LET a1=x1: LET b1=y1
 110 IF ATTR (x,y+y1)<>56 THEN LET y1=(y1=-1)-(y1=1)
 120 IF ATTR (x+x1,y)<>56 THEN LET x1=(x1=-1)-(x1=1)
 122 BEEP .003,2*time
 125 IF a1=x1 AND b1=y1 AND ATTR (x+x1,y+y1)<>56 THEN LET x1=(x1=-1)-(x1=1): LET y1=(y1=-1)-(y1=1)
 128 PRINT INK 1;AT x,y;"E"
 130 LET x=x+x1: LET y=y+y1
 140 IF p=30-n AND ladder=0 THEN PRINT AT a,b;" ": BEEP .1,10: LET ladder=1: FOR f=16 TO 20: PRINT AT f,31-n;" ": NEXT f: NEXT n
 150 IF p=9 AND ladder=1 AND o=n*4+7 THEN BEEP .1,5: LET ladder=0: FOR f=n*4+5 TO 20: PRINT INK 2;AT f,8;"B": NEXT f
 200 LET p=p+(INKEY$="8" AND p<30-n AND o=19)-(INKEY$="5" AND (o=3 OR (o=19 AND p>9)))
 210 IF p=9 THEN LET o=o+(INKEY$="6" AND o<19)-(INKEY$="7" AND o>dist): BEEP .005,10
 215 PRINT AT 7,time+10; PAPER 7; INK 2;"O"
 220 LET time=time+.085: IF time>=17 THEN LET a$="THE THING ON THE CHURCH GOT YOU": GO TO 5000
 230 PRINT AT 7,time+10; PAPER 7; INK 0;"N"
 490 PRINT PAPER 1; INK 7;AT 10,v;"O"
 500 GO TO 100
 999 REM   HANGING
1000 FOR n=10 TO 0 STEP -.2: BEEP .005,n: NEXT n: FOR n=0 TO 18: PRINT AT n,p; PAPER 8;"K": NEXT n
1010 FOR n=18 TO 0 STEP -1: BEEP .005,n: BEEP .005,n+5: PRINT AT n,p; PAPER 8;"K";AT n+1,p;"L";AT n+2,p;"C";AT n+3,p;"D";AT n+4,p;" ": NEXT n
1050 LET a$="THE DEMOLITION BALL HIT YOU": GO TO 5000
1999 REM  MOVING CLOCK
2000 FOR n=18 TO 1 STEP -1: PRINT AT n,28;"K";AT n+1,28;"L";AT n+2,28;" ": BEEP .01,n: NEXT n
2010 FOR n=28 TO 6 STEP -1: PRINT AT 1,n;"K ";AT 2,n;"L ": BEEP .01,n: NEXT n
2020 FOR n=1 TO 24: PRINT AT 1,n;" "; PAPER 6; INK 2;"JJJJ"; PAPER 7;"K";AT 2,n;" "; PAPER 6;"JGFJ"; PAPER 7;"L";AT 3,n;" "; PAPER 6;"JHIJ";AT 4,n; PAPER 7;" "; PAPER 6;"JJJJ"
2030 IF INKEY$<>"0" THEN BEEP .01,n: NEXT n: FOR f=1 TO 4: PRINT AT f,24;"        ": NEXT f: GO TO
```

(continued on page 179)

(continued from page 177)

```
 2020
2040 IF n<>9 THEN LET a$="[illegible]": GO TO 5000
2050 FOR n=5 TO 8: PRINT AT n,10:; PAPER 6; INK 2;"[illegible]": NEXT n
2060 PRINT AT 5,11; INK 6; PAPER 1;"[illegible]";AT 6,11;"[illegible]"
2070 FOR f=1 TO 5: FOR n=1 TO 10: BEEP .01,n*f: NEXT n: NEXT f
2080 LET a=0: LET a$="YOU HAVE BUILT THE CHURCH TOWER "
5000 FOR n=0 TO 2 STEP .08: PRINT AT 3,10; BRIGHT 1; INK n;"HARD LUCK...";AT 3,9;("[illegible]" AND a=0)'a$;AT 18,12;"ANOTHER GO ?"
5010 IF INKEY$="y" OR INKEY$="Y" THEN RUN
5050 IF INKEY$<>"n" AND INKEY$<>"Y" THEN NEXT n: GO TO 5000
5060 STOP
9000 SAVE "<<DOOM>>" LINE 9050: SAVE "<<CHURCH>>"CODE USR "a",188
9010 VERIFY "": VERIFY ""CODE : RUN
9050 CLS : PRINT AT 11,0;"Bytes:";AT 9,7;"<<<DOOM>>>": OVER 1: LOAD ""CODE : PAUSE 200: OVER 0: RUN
```

Heli-rescue

DRAGON

C J Davies and M E Wilson,
Bishop's Cleve,
Cheltenham.

THE HELI-RESCUE program was written to run on a standard Dragon 32 with one joystick. The aim is to rescue the raft from the sea using the helicopter.

The game starts with the helicopter on the helipad, from which you must fly the helicopter and position it over the raft, allowing its ski just to touch the raft. The raft will then disappear signifying that it has been picked up. Do not allow the helicopter to touch the sea or you will be swamped and crash. You must then fly back to the helipad and land safely.

The helicopter is controlled by using the right joystick, the up and down movement of which controls the throttle. Under the helipad is a tilt indicator showing the angle of the rotor blades, which will divert some of the vertical thrust into horizontal thrust, enabling the helicopter to move forwards and backwards. The tilt is controlled by the left and right movement of the joystick.

The animation is achieved by using all the high-resolution graphic pages and creating two screens. By writing to one screen while displaying the other and swapping the two screens at the end of the write leads to a much smoother motion effect.

Remember; the helicopter has inertia and its motion will not respond instantaneously to the controls.

```
100 POKE &HFFD6,0
110 REM *************************
120 REM *                       *
130 REM * HELICOPTER  FLIGHT    *
140 REM *     SIMULATOR         *
150 REM *                       *
160 REM * WRITTEN ON:  3/4/83   *
170 REM *      BY:              *
180 REM *        M.E.WILSON     *
190 REM *     & C.J.DAVIES      *
200 REM *                       *
210 REM *************************
220 CLS:PRINT:PRINT "  HELICOPTER FLIGHT SIMULATOR":PRINT@100,"BY:       C.J.DAVIES":PRINT@139,"& M.E.WILSON":PRINT@260,"DO YOU WANT":PRINT@295,"INSTRUCTIONS(Y/N)";
230 Q$=INKEY$:IF Q$="" THEN 230 ELSE IF Q$="N" THEN 470
240 IF LEFT$(Q$,1)<>"Y" THEN 220
250 CLS:PRINT "  HELICOPTER FLIGHT SIMULATOR"
260 PRINT:PRINT " THE OBJECT OF THE GAME IS TO   RESCUE THE RAFT FROM THE SEA."
270 PRINT:PRINT "TO DO THIS YOU HAVE TO FLY THE  HELICOPTER, BY MEANS OF THE JOYSTICK, UNTIL YOU JUST TOUCH  THE RAFT WITH THE SKI OF THE    HELICOPTER."
280 PRINT:PRINT "THE RAFT WILL DISAPPEAR AS YOU  PICK IT UP AND THEN YOU HAVE TO LAND WITH IT BACK AT THE HELIPAD"
290 GOSUB 1000
300 CLS:PRINT:PRINT " TO FLY THE HELICOPTER YOU NEED  THE RIGHT JOYSTICK."
310 PRINT:PRINT " TO INCREASE THE LIFT USE MORE  THROTTLE. I.E.PUSH THE JOYSTICK UP."
320 PRINT " TO COME DOWN REDUCE THE POWER  BY PULLING THE JOYSTICK DOWN"
330 PRINT:PRINT "remember THE HELICOPTER HAS                   INERTIA AND WON'T         RESPOND IMMEDIATELY."
340 GOSUB 1000
350 CLS:PRINT " TO GO LEFT OR RIGHT USE THE    TILT INDICATOR UNDER THE HELIPADTHIS SHOWS THE ANGLE OF THE     ROTOR BLADES."
360 PRINT:PRINT " WHICHEVER WAY THE BLADES ARE   TILTED WILL DIVERT SOME OF THE DOWN THRUST TO SIDE THRUST TO   ENABLE THE HELICOPTER TO FLY    BACKWARDS OR FORWARDS."
370 PRINT:PRINT" TO STOP MOVING IN ONE DIRECTIONYOU WILL HAVE TO APPLY THRUST IN THE OTHER DIRECTION UNTIL THE   HELICOPTER IS STOPPED."
380 GOSUB 1000
390 CLS:PRINT "            SUMMARY"
400 PRINT:PRINT "JOYSTICK                 ACTION"
410 PRINT "POSITION"
420 PRINT:PRINT "  UP                MORE THRUST"
430 PRINT:PRINT " DOWN               LESS THRUST"
440 PRINT:PRINT " LEFT             TILT BLADES LEFT"
450 PRINT:PRINT " RIGHT            TILT BLADES RIGHT"
460 GOSUB 1000
470 CLS:PRINT@267,"GOOD LUCK";
480 PLAY "T6O2L2.BL4BO3L4CCF4O2L4BO3L4CO2L4BAGL1F#P4O3L2DCO2L8BO3L8CO2L8AO3L4DCO2L2BAL1G;"
490 POKE &HFFD7,0
500 PCLEAR8:PMODE 3,1:COLOR 5,7:PCLS
510 DIM H(19,9),B(19,9):DIM N$(20)
520 GET(0,0)-(19,9),B,G
530 DRAW "BM0,0;R6NR7D1R1D1L1D1L4R17D1L17D1R9D1L9;R2D1R1BM+3,+0;R1BM+2,+1;L1;BM-7,+0;L1D1L2R1J;BM+5,-0;R1D1L1D3R1D1L1;"
540 GET (0,0)-(19,9),H,G
550 PCLS:COLOR 6,7:LINE(0,192)-(255,170),PSET,BF
560 COLOR 8,7:LINE(215,192)-(255,152),PSET,BF
570 COLOR 5,7:LINE(100,169)-(110,168),PSET,BF
580 CIRCLE(235,172),15:PAINT(235,172),5,5
590 FOR P=8 TO 5 STEP -1:PCOPY (P-4) TO P:NEXT
600 FOR X=0 TO 214 STEP 16:FOR X1=0 TO 8:FOR Y1=0 TO 1:PSET(X+X1,170+Y1,7):NEXT Y1,X1,X
610 PMODE 3,5:FOR X=8 TO 214 STEP 16:FOR X1=0 TO 8:FOR Y1=0 TO 1:PSET(X+X1,170+Y1,7):NEXT Y1,X1,X:PMODE 3,1
620 M=5:T=0:X=225:Y=141:VH=0:VV=0:FLAG=0:LA=225:LB=172:LX=245:LY=172:MA=LA:MB=LB:MX=LX:MY=LY:TX=X:TY=Y
630 COLOR 5,7:LINE(LA,LB)-(LX,LY),PRESET
640 PUT(X,Y)-(X+19,Y+9),H,PSET
650 SCREEN 1,1
660 PMODE 3,M:M=6-M:COLOR 5,7
670 PUT(TX,TY)-(TX+19,TY+9),B,PSET
680 LINE(MA,MB)-(MX,MY),PSET
690 DT=JOYSTK(0):TH=JOYSTK(1)
700 T=T+(32-DT)*0.001:ST=SIN(T):CT=COS(T)
710 MA=LA:MB=LB:MX=LX:MY=LY:LA=235-10*CT:LB=172+10*ST
720 LX=235+10*CT:LY=172-10*ST
730 LINE(LA,LB)-(LX,LY),PRESET
740 VV=VV-(63-TH)*CT/32+1:VH=VH+ST
750 TX=X:TY=Y:X=X-VH:Y=Y+VV
760 IF PPOINT(TX+10,TY+10)=8 AND Y>TY THEN Y=TY:X=TX
770 IF X<0 THEN X=0:VH=0
780 IF X>235 THEN X=235:VH=0
790 IF Y<0 THEN Y=0:VV=0
800 PUT (X,Y)-(X+19,Y+9),H,PSET
810 IF PPOINT(X+10,Y+10)=7 THEN 650
820 SCREEN 1,1
830 P=PPOINT(X+10,Y+10):IF P=6 THEN 910
840 IF P=5 THEN FLAG=1:LINE(100,169)-(110,168),PRESET,B:PMODE 3,M:COLOR 5,7:LINE(100,169)-(110,168),PRESET,B:PMODE3,6-M:COLOR 5,7:GOTO 650
850 IF VV>2 OR ABS(VH)>2 THEN 910
860 IF FLAG=0 THEN VV=0:VH=0:GOTO 650
870 CLS:PRINT@256,"C O N G R A T U L A T I O N S !"
880 FOR I=1 TO 4:PLAY"T50V30O2CDEFGABO3CDEFGAB;":NEXT
890 PRINT:PRINT:PRINT"    YOU HAVE LANDED SAFELY":PRINT"           WITH THE RAFT"
900 GOTO 970
910 FOR N=1 TO 10
920 SCREEN 1,0:FOR DL=1 TO 100:NEXT
930 SCREEN 1,1:FOR DL=1 TO 100:NEXT
940 NEXT
950 FOR N=1 TO 4:CLS5:PRINT@256,"! ! ! ! D I S A S T E R ! ! ! ! ";:PLAY"T100V30O3BAGFEDCO1BAGFEDC;":FOR DL=1 TO 250:NEXT:CLS3:FOR DL=1 TO 150:NEXT DL,N
960 CLS
970 PRINT@448,"ANOTHER GAME (Y/N)";:Q$=INKEY$:IF Q$=""THEN 970
980 IF Q$="Y" THEN RUN
990 CLS:POKE&HFFD6,0:END
1000 PRINT@480,"HIT ANY KEY TO CONTINUE";
1010 Q$=INKEY$:IF Q$="" THEN 1010 ELSE RETURN
```

Snake.

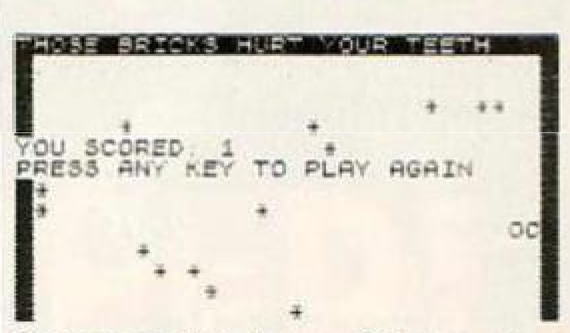
```
  1 LET HS=0
  5 CLS
 10 LET A=30
 30 LET SCORE=0
 40 LET SH=0
 90 POKE 16418,0
 95 LET A=A+INT (RND*16)+7
 96 CLS
 97 DIM S(1200)
 98 LET N=0
100 LET A$="[illegible]"
110 LET B$="[illegible]"
120 PRINT A$
130 FOR B=1 TO 22
140 PRINT B$
150 NEXT B
160 PRINT A$
161 LET H$=STR$ HS
162 FOR B=1 TO LEN H$
163 LET H$(B)=CHR$ (CODE (H$(B))+128)
164 NEXT B
170 PRINT AT 23,10;"HIGH SCORE [illegible]";H$
180 FOR B=1 TO A
181 LET W=INT (22*RND+1)
182 LET Z=INT (30*RND+1)
183 PRINT AT W,Z;
184 IF PEEK (PEEK 16398+256*PEEK 16399)<>0 THEN GOTO 181
185 IF W=9 AND Z<4 THEN GOTO 181
190 PRINT AT W,Z;"*"
200 NEXT B
210 LET X=(PEEK 16396+256*PEEK 16397)+300
220 LET M=1
230 LET Y=X
280 FOR T=1 TO 1200
285 LET S(T)=X
300 IF INKEY$<>"" THEN LET N=(INKEY$="8")+(INKEY$="6")*33-(INKEY$="5")-(INKEY$="7")*33
305 IF N<>0 THEN LET M=N
310 IF PEEK (X+M)>40 THEN GOTO 570
320 IF PEEK (X+M)<>0 THEN LET SCORE=SCORE+1
323 POKE X,52
324 POKE (X+M),40
330 POKE (S(T-SCORE+SH)),0
370 IF A=SCORE-SH THEN GOTO 500
380 IF T=1200 THEN GOTO 550
395 LET X=X+M
400 NEXT T
500 LET SH=SCORE
510 PRINT AT 0,0;"YOUR SCORE IS NOW: ";SCORE
520 FOR B=1 TO 60
530 NEXT B
540 GOTO 95
550 PRINT AT 0,0;"SORRY YOU RAN OUT OF TIME :"
570 IF PEEK (X+M)=52 THEN PRINT AT 0,0;"[illegible]"
```

(continued on next page)

Snake

P J Martyn,
Chippenham,
Wiltshire.





SNAKE IS ALL Basic but uses Poke to speed up the action. The object is to eat all the food pellets — * — without biting yourself or the bricks of the pit. The cursor keys are used to move the snake, and a time limit in the For-Next loop with variable T will stop the game. The high score is always displayed.

(continued from previous page)

```
 580 IF PEEK (X+M)=128 THEN PRIN
T AT 0,0;"THOSE BRICKS HURT YOUR
 TEETH               "
 600 PRINT AT 5,0;"YOU SCORED: "
;SCORE;"          "
 605 IF SCORE>HS THEN LET HS=SCO
RE
 610 POKE 16418,2
 620 PRINT "PRESS ANY KEY TO PLA
Y AGAIN"
 625 IF INKEY$<>"" THEN GOTO 625
 630 IF INKEY$="" THEN GOTO 630
 635 COPY
 640 GOTO 5
```

Pin Ball

Andy Duffin,
Scunthorpe,
South Humberside.

VIC-20

PIN BALL is for the unexpanded Vic-20. The game is really a cross between Breakout and Pinball. The program is in two parts. Part 1 gives brief instructions and also defines the graphics.

Part 1 should always be loaded and run before part 2. Part 2 is the main program and makes full use of colour and also contains an 80-byte machine-code subroutine that moves the bat.

You must control the boat that is at the bottom of the screen, to rebound the moving ball.

Points are gained when the ball hits the targets that are on the screen. You have only two chances and each ball has a number on it.

There are four keys that can be used: left, Z and '; right, C and /.

Part 1

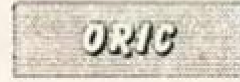
```
 10 PRINT"▮▮▮":POKE36879,255
 20 PRINT"▮▮          ¬IN              ▮";
 30 PRINT"▮             !ALL          ▮";
 40 PRINT"               ▮! r
 50 PRINT"          ▮▮♦NDY ¬UFFIN"
 51 FORA=1TO5000:NEXT:PRINT"▮"
 60 PRINT"▮ !HIS IS A VERSION OF  THE POPULAR ARCADE    GAME,▮▮\/
▮ ▮!♦LL▮."
 70 PRINT"▮ /SE KEYS ♦ AND - OR   , AND / TO REBOUND    THE BALL."
 80 PRINT"▮     ▮▮▮ ▮,▮ - LEFT"
 90 PRINT"      ▮▮ ▮/▮ - _IGHT"
 100 PRINT"▮  DU HAVE ONLY !or     CHANCES."
 110 PRINT"▮ ♦CORES RANGE FROM 10  POINTS TO 40 POINTS"
 121 V=36878:FORR=1TO3:RESTORE
 122 FORA=1TO12
 123 READN,T
 124 FORL=1TON:POKE36874,T:POKEV,8:NEXTL
 125 POKEV,0
 126 NEXTA,R
 127 DATA20,195,20,195,45,209,45,215,20,219,45,219,20,195,20,209,20,
209,20,215,20,215
 128 DATA45,219
 130 POKE52,28
 140 FORA=7168TO7679:POKEA,PEEK(A+25600):NEXT
 150 FORA=7168TO7168+8*9-1:READB:POKEA,B:NEXT
 160 DATA255,255,255,255,255,255,255,255:REM BAT @
 170 DATA255,255,255,255,255,255,255,255:REM BAT A
 180 DATA255,255,255,255,255,255,255,255:REM BAT B
 190 DATA60,66,153,137,137,137,66,60:REM BALL 1 C
 200 DATA60,66,185,137,145,189,66,60:REM BALL 2 D
 210 DATA24,102,153,165,165,153,102,24:REM POINTS 10 E
 220 DATA255,195,165,153,153,165,195,255:REM POINTS 20 F
 230 DATA153,90,60,255,255,60,90,153:REM POINTS 30 G
 240 DATA153,36,90,165,165,90,36,153:REM POINTS 40 H
 250 FORR=0TO5000:NEXT
 251 POKE56,28:POKE52,28:POKE51,0:POKE55,0
 257 DATA244,29,96
 300 PRINT"▮▮/OW LOAD ¬ART I[▮":END
```

Part 2

```
 0 REM(C)A.DUFFIN 1983
 1 HS=0:GOSUB5000:PRINT"▮"
 2 SC=0:P=10
 5 FORBL=3TO4
 6 POKE350,160:POKE351,10:POKE352,96:SYS350
 10 POKE36879,29:PRINT"▮":DX=-1:DY=-1:P=9:BA=8143:POKE36869,255
 11 POKE36874,0:POKE36875,0:POKE36876,0:POKE36877,0:POKE36878,0
 15 X=20
 17 Y=4
 20 FORA=7702TO7723:POKEA+30720,2:POKEA+462+30720,2
 30 POKEA,0:POKEA+462,0:NEXT
 40 FORA=7724TO8142STEP22
 50 POKEA+30720,2:POKEA+21+30720,2
 60 POKEA,0:POKEA+21,0:NEXT
 65 PRINT"▮▮▮▮▮▮▮▮▮PIN BALL▮"
 70 PRINT"▮▮▮▮▮▮     H    ▮ EE      ▮H"
 80 PRINT"▮▮▮▮▮▮▮          ▮G        G"
 90 PRINT"▮▮▮▮▮▮▮▮▮    G       ▮ FF       G"
 100 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮        ▮E       ▮GG       ▮E  ▮  "
 110 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮   A      A      A      A"
 120 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮    ▮E                  E"
 121 FORRR=38863TO38882:POKERR,0:NEXT:SYS830
 125 GOSUB30000
 150 POKE7680+X+Y*22,32
 160 SYS832
 200 X=X+DX:Y=Y+DY
 285 IFPEEK(7680+X+Y*22+22)=2THENDY=-DY:N=220:SC=SC+5:GOSUB10000
 290 B=PEEK(7680+X+Y*22):IFB<>32THEN500
 300 POKE38400+X+Y*22,0:POKE7680+X+Y*22,BL:FORQQ=1TO10:NEXT
 310 IFX=1ORX=20THENDX=-DX:N=250:GOSUB10000
 320 IFY=2THENDY=-DY:N=250:GOSUB10000
 330 IFY>=21THEN50000
 340 SYS832
 400 GOTO150
 500 IFB=5THENSC=SC+10:N=190:GOSUB20000:Y=Y+DY:X=X+DX
 510 IFB=6THENSC=SC+20:N=200:GOSUB20000:X=X+DX:Y=Y+DY
 520 IFB=7THENSC=SC+30:N=210:GOSUB20000:Y=Y+DY:X=X+DX
 530 IFB=8THENSC=SC+40:N=220:GOSUB20000:X=X+DX:Y=Y+DY
 540 GOSUB10000
 550 IFB=1THENDX=-DX:X=X+DX
 560 GOTO300
 5000 I=830
 5010 READA:IFA=-1THENRETURN
 5020 POKEI,A:I=I+1:GOTO5010
 5030 DATA162,10,164,197,192,33,240,13,192,29,240,9,192,34,240,17,
192,30,240,13,96
 5040 DATA224,1,240,251,32,107,3,202,32,119,3,96,224,18,240,251,32,
107,3,232,32,119,3,96
 5050 DATA169,32,157,206,31,157,207,31,157,208,31,96,169,2,157,206,
31,157,207,31,157,208
 5060 DATA31,169,00,157,206,151,157,207,151,157,208,151,96,-1
 10000 POKE36878,15
 10010 POKE36876,N:POKE36876,0:POKE36878,15
 10020 PRINT"▮ ▮▮SCORE=";SC
 10030 RETURN
 20000 Z=INT(RND(TI)*9)+1
 20010 IFZ=1THENDX=-DX:RETURN
 20020 IFZ=2THENDY=-DY:RETURN
 20030 IFZ=3THENDY=-DY:DX=-DX:RETURN
 20040 IFZ=4THENDX=-DX:RETURN
 20050 IFZ=5THENDY=-DY:RETURN
 20060 IFZ=6THENDX=-DX:DY=-DY:RETURN
 20070 IFZ=7THENDX=-DX:RETURN
 20080 IFZ=8THENDY=-DY:RETURN
 20090 IFZ=9THENDX=-DX:RETURN
 30000 POKE36878,15:POKE198,0
 30005 IFPEEK(197)=64THEN30005
 30010 POKE198,0
 30020 FORZ=8161TO7765STEP-22:POKEZ,BL:POKEZ+30720,0
 30030 POKE36877,200:FORRR=0TO25:NEXT
 30040 POKEZ,32:NEXT:POKEZ-1,BL
 30050 POKE36877,0:POKE36878,0:RETURN
 50000 POKE36878,15:POKE36875,150:POKE36876,150:FORRR=1TO2000:NEXT
POKE36875,0
 50001 POKE36876,0:NEXTBL
 50004 POKE36878,15:POKE36876,0
 50005 IFSC>HITHENFORAA=128TO255STEP2:POKE36876,AA:FORA$=1TOAASTEP
10:NEXT:NEXT:HI=SC
 50010 POKE36876,0
 50011 PRINT"▮▮▮▮▮HISCORE="HI
 50020 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮HIT KEY TO START"
 50100 IFPEEK(197)=64THEN50100
 50101 GOTO2
```

Light-Bikes

I M Cawte,
Coulsdon,
Surrey.



HERE IS MY PROGRAM called Light-Bikes for the 48K Oric 1. The object of the game is to force your opponent — the computer — to crash. You control your light-bike with the cursor keys at the bottom of the keyboard and are not allowed to touch the sides of the playing area or your or the computer's trail.

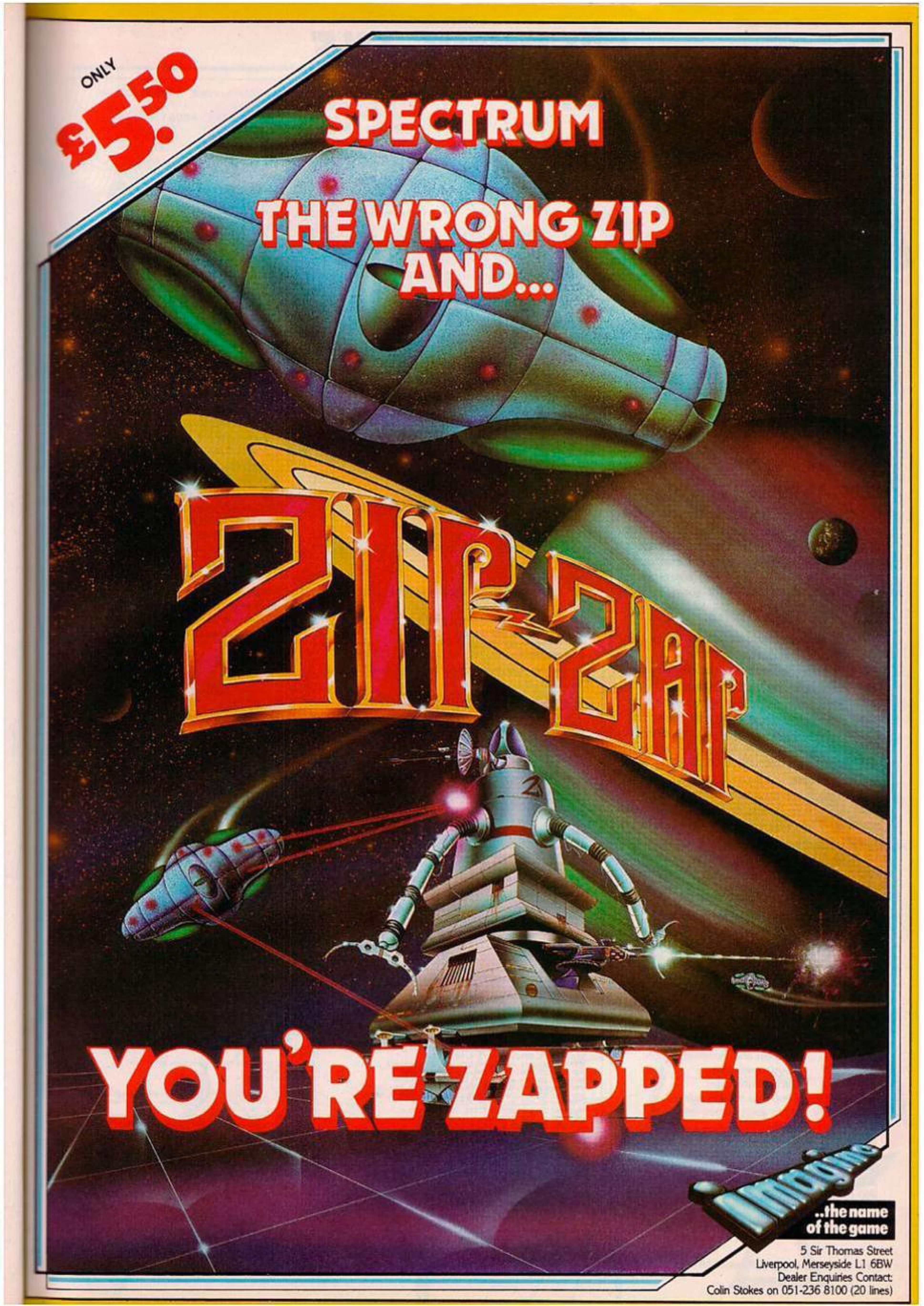
You cannot double back on yourself. The game is very fast because it uses the technique of Poking characters to the screen. The game is over when either you or the computer has lost 10 times. You will find your Oric a difficult opponent to beat.

Here is a breakdown of the program:

1000	reads keyboard.
1005 1006	sound effects.
2000	check where your light bike is going.
3000	check computer s bike.
6000 6140	change computer s direction.
10000 to 10999	set up bikes positions, directions, print screen.
10010	turn off cursor, turn off keyclick.
20000 20050	update scores.
20500 30130	end of game routines.

```
500 GOSUB 10000
1000 KY=PEEK(520)
1005 SOUND 1,S,7
1006 S=S-4:IF S<300 THEN S=500+(L*100):L=L+1
1010 IF KY=172 THEN D1=-1
1020 IF KY=188 THEN D1=1
1030 IF KY=156 THEN D1=-40
1040 IF KY=180 THEN D1=40
2000 IF PEEK(B+D1)<>32 THEN F=2:GOTO20000
2010 B=B+D1
2020 POKE B,255
3000 IF PEEK(A+D2)<>32 THEN GOSUB 6000
3010 A=A+D2
3020 POKE A,254
5000 GOTO 1000
6000 IF J=1 THEN 6090
6001 J=1:IF UP=40 THEN 6010
6005 IF PEEK(A-40)=32 THEN D2=-40:UP=-40:RETURN
6010 IF PEEK(A+40)=32 THEN D2=40:UP=40:RETURN
6020 IF PEEK(A-40)=32 THEN D2=-40:UP=-40:RETURN
6040 F=1:GOTO 20000
6090 J=0:IF AC=-1 THEN 6110
6100 IF PEEK(A+1)=32 THEN D2=1:AC=1:RETURN
6110 IF PEEK(A-1)=32 THEN D2=-1:AC=-1:RETURN
```

(continued on page 182)



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(continued from page 180)

```
6120 IF PEEK(A+1)=32 THEN D2=1:AC=1:RETURN
6140 F=1:GOTO 20000
6190 IF AC=-1 THEN 6110
10000 A=48220:B=48820:D1=-40:D2=40:J=1
10002 D=INT(RND(1)*4):IF D=0 THEN D2=-40:
10003 IF D=1 THEN D2=1:J=0
10004 IF D=2 THEN D2=-1:J=0
10005 PING
10006 S=500:L=1
10010 POKE 618,10
10100 CLS:PAPER0:INK6
10190 FOR I=46080+((ASC(":"))*8) TO 46080+((ASC(":"))*
8)+7:POKE I,6
3:NEXT I
10200 FOR I=0 TO 26:PLOT 1,I,":":PLOT 38,I,":":NEXT I
10210 FOR I=1 TO 37:PLOT I,0,":":PLOT I,26,":":NEXT I
10220 PLOT 2,13,":":PLOT 37,13,":"
10300 POKE A,254:POKE B,255
10400 PRINT"::::::YOU::::::::::::::::::::::ORIC::::::"
10410 POKE 48055,YOU+48:POKE 48064,ME+48
10999 RETURN
20000 EXPLODE
20001 IF F=1 THEN YOU=YOU+1:POKE 48055,YOU+48
20010 IF YOU=10 THEN 20500
20020 IF F=2 THEN ME=ME+1:POKE 48064,ME+48
20030 IF ME=10 THEN 20600
20040 EXPLODE:WAIT 100
20045 S=500
20050 GOTO 500
20500 A$="  WELL DONE"
20510 B$="YOU BEAT ME 10:"+STR$(ME)
20520 GOTO 30000
20600 A$=" TOUGH LUCK"
20610 B$=" I BEAT YOU 10:"+STR$(YOU)
30000 PLOT 10,5,10:PLOT 10,6,10
30010 PLOT 13,5,A$:PLOT 13,6,A$
30020 PLOT 7,13,10:PLOT 7,14,10
30030 PLOT 10,13,B$:PLOT10,14,B$
30040 PLOT 7,21,10:PLOT 7,22,10
30050 PLOT10,21,"PLAY AGAIN ? (Y/N)"
30060 PLOT10,22,"PLAY AGAIN ? (Y/N)"
30100 GET Z$
30110 IF Z$="Y"THEN RUN
30120 IF Z$<>"N" THEN 30100
30130 END
```

Meteors

John Wilson, Benfleet, Essex.



METEORS IS A game for the BBC Micro Model B or Model A with 32K RAM. The idea of the game is to avoid the meteors as you fly through a storm. You gain points by staying alive, or bonus points can be gained by collecting the crosses. You gain more points the lower you descend into the storm, or even more points for reaching the bottom of the screen.

The controls used are as follows: A for left; D for right; X for thrust.

The thrust control only works when you have collected enough fuel — the crosses — to enter hyperdrive. This allows you to reach the bottom of the screen, and the next stage, very quickly. The further you get in the storm the more fuel you require to thrust. You start off with three ships, and will lose one every time you hit a meteor.

Although it sounds a very simple game, it is quite difficult to master and the graphics are excellent. The program is relatively short and should pose no problems when typing it in. To help with converting the program to a different computer, I will give a description of what the different parts of the program do.

Line	Use
10 to 20	Set up envelope statements.
30 to 280	Print out instructions in double-height lettering.
300 to 340	Set up high-score table.
410	Read the character at cursor position. Please change the £ to a #.
440 to 620	Set up colours, user-defined characters, and make the cursor invisible.
640 to 670	Print up and increment score.
680 to 730	Your movement.
740 to 750	Background stars.
760 to 790	Keep you on the screen.
800	Have you crashed into an asteroid?
810	Have you collected a cross?
820 to 830	Print your spaceship.
840	Add a cross to the screen.
850 to 880	Add an asteroid.
890 to 970	Print an asteroid of random size.
980 to 1100	You have hit a meteor, explosion routine.
1120 to 1150	Any ships left?
1160 to 1180	Print your score.
1190 to 1230	Is it good enough to be put in the hig- score table?
1240 to 1350	Print high-score table.
1360 to 1390	Find the character at the given screen co-ordinates.
1400 to 1540	Completed a stage.
1550 to 1690	Enter your name into the high score table.
1700 to 1760	Error in program.
1770 to 1800	Print string in double-height.

Variables.

Variable	Use
H%	Position in memory where list of high scores are kept.
N%	Position in memory where the list of names are stored.
STAGE	Stage number.
L%	Amount of fuel so far collected.
ST%	General counter.
SHIP	Number of ships left.
Y	Y co-ordinate of ship.
O%	Start of read character at cursor position routine.
SC	Score.
X	X co-ordinate of ship.
K	Movement direction of ship.
T	Size of asteroid to be printed.
X1	X co-ordinate of asteroid.
Y1	Y co-ordinate of asteroid.
I	General loop.
FL	Where your score is placed in the high-score table.
A	General delay, local variable.
B	Local variable.
A$	Your name, local variable.

```
   10 ENVELOPE 1,3,-10,-10,-10,1,1,1,-1,-1,-1,-1,50,12
0
   20 ENVELOPE 2,22,16,12,8,1,1,1,10,-10,0,-10,100,50
   30 MODE 7
   40 PROCL("             M E T E O R S")
   50 PROCL("   Dodge the advancing meteors and")
   60 PROCL("collect the crosses before you are")
   70 PROCL("destroyed.Head for the bottom of the")
   80 PROCL("screen and collect bonus points for")
   90 PROCL("completing the stage.The computer")
  100 PROCL("will inform you when you have enough")
  110 PROCL("energy to go into hyperdrive.")
  120 PROCL("You have three ships to your disposal")
  130 PROCL("But they don't last long in the meteor")
  140 PROCL("storm.")
  150 PROCL("Press the SPACE BAR to contine.")
  160 REPEAT UNTIL GET$=" "
  170 CLS
  180 PROCL("The following keys control your craft:")
  190 PROCL("     A for left")
  200 PRINT
  210 PROCL("     D for right")
  220 PRINT
  230 PROCL("     X for thrust.")
  240 PRINT
  250 PROCL("   More points are gained,the further")
  260 PROCL("you travel into the storm.")
  270 PROCL("Press the SPACE BAR to start.")
  280 REPEAT UNTIL GET$=" "
  290 ON ERROR GOTO 1700
  300 H%=2560
  310 N%=2600
  320 FOR I=0 TO 4
  330 IF VAL($(H%+I*7))=0 THEN $(H%+I*7)="000000":$(N%
+I*20)="********************"
  340 NEXT
  350 STAGE=0
  360 L%=0
  370 ST%=0
  380 SHIP=3
  390 Y=5
  400 DIM O% 10
  410 P%=O%:[OPT0:LDA#135:JSR &FFF4:STX&70:RTS:]
  420 SC=0
  430 MODE 1
  440 VDU 19,2,2,0,0,0
  450 VDU 23;8202;0;0;0;
  460 VDU 23,225,0,48,248,252, 254,124,24,0
  470 VDU 23,226,0,0,2,7,15,15,31,63
  480 VDU 23,227,0,0,0,160,240,248,248,252
  490 VDU 23,228,127,63,127,127,63,31,15,7
  500 VDU 23,229,252,252,252,248,240,224,192,128
  510 VDU 23,230,0,0,0,7,15,15,31,31
  520 VDU 23,231,0,28,124,255,255,255,255,255
  530 VDU 23,232,0,0,0,128,192,224,240,248
  540 VDU 23,233,63,63,127,127,127,127,63,63
  550 VDU 23,234,255,255,255,255,255,255,255,255
  560 VDU 23,235,248,252,252,248,248,240,240,248
  570 VDU 23,236,31,15,15,7,3,1,0,0
  580 VDU 23,237,255,255,255,227,224,192,0,0
  590 VDU 23,238,248,240,240,240,224,0,0,0
  600 VDU 23,239,0,62,65,34,34,20,20,8
  610 VDU 23,240,0,24,44,68,98,50,13,3
  620 VDU 23,241,0,24,52,34,70,76,176,192
  630 X=20:K=1
  640 ST%=ST%+1
  650 COLOUR 3
  660 PRINT TAB(X,Y);" ";TAB(0,31)'TAB(0,0);"SCORE = "
;SC
  670 SC=SC+Y
  680 K=1
  690 IF INKEY(-66) THEN K=3:X=X-1
  700 IF INKEY(-51) THEN K=2:X=X+1
  710 IF L%<(STAGE+1)*5 THEN 740
  720 IF L%=(STAGE+1)*5 THEN SOUND 3,1,100,20:L%=L%+1
  730 IF INKEY(-67) THEN Y=Y+1:SOUND 0,17,6,1
  740 GCOL 0,RND(3)
  750 PLOT 69,RND(1280),0
  760 IF ST% MOD 100=0 THEN Y=Y+1
  770 IF Y>=26 THEN PROCbonus
  780 IF X<1 THEN X=1
  790 IF X>39 THEN X=39
  800 IF FNP(X,Y)>224 THEN PROChit
  810 IF ?&70=43 THEN SOUND 3,17,100,3:SC=SC+STAGE*50+
50:L%=L%+1
  820 COLOUR 3
  830 PRINT TAB(X,Y);CHR$(238+K);
  840 IF RND(5)=1 THEN PRINT TAB(RND(39),30);"+";
  850 T=RND(3)
  860 X1=RND(40-T):Y1=30-T
  870 COLOUR RND(3)
  880 ON T GOTO 890,910,940
  890 PRINT TAB(X1,Y1);CHR$(225)
  900 GOTO 640
  910 PRINT TAB(X1,Y1);CHR$(226);CHR$(227);
  920 PRINT TAB(X1,Y1+1);CHR$(228);CHR$(229)
  930 GOTO 640
  940 PRINT TAB(X1,Y1);CHR$(230);CHR$(231);CHR$(232);
  950 PRINT TAB(X1,Y1+1);CHR$(233);CHR$(234);CHR$(235)
;
  960 PRINT TAB(X1,Y1+2);CHR$(236);CHR$(237);CHR$(238)
  970 GOTO 640
  980 DEFPROChit
  990 PRINT TAB(X-1,Y-1);"\|/"
 1000 PRINT TAB(X-1,Y);"-X-"
 1010 PRINT TAB(X-1,Y+1);"/|\"
 1020 FOR I=0 TO 7
 1030 VDU 19,1,8-I,0,0,0
 1040 SOUND 0,17,I MOD 2+5,2
 1050 NEXT
 1060 FOR I=0 TO 7
 1070 VDU 19,1,I,0,0,0
 1080 SOUND 0,17,I MOD 2+5,2
 1090 NEXT
 1100 VDU 20
 1110 CLS
 1120 SHIP=SHIP-1
 1130 Y=5
 1140 VDU 19,2,2,0,0,0
 1150 IF SHIP>0 THEN ENDPROC
 1160 MODE7
 1170 PRINT ''''"Your score was ";SC
 1180 *FX 15,1
 1190 FL=-1
 1200 FOR I=4 TO 0 STEP -1
 1210 IF SC>VAL($(H%+I*7)) THEN FL=I
 1220 NEXT
 1230 IF FL>=0 THEN PROChighscore:GOTO 1260
 1240 *FX15,1
 1250 A=INKEY(300)
 1260 CLS
 1270 PRINT ''CHR$141;"Todays top five scores are:"
 1280 PRINT CHR$141;"Todays top five scores are:"
 1290 FOR I=0 TO 4
 1300 PRINT 'CHR$141;$(H%+I*7);"   ";$(N%+I*20)
 1310 PRINT CHR$141;$(H%+I*7);"   ";$(N%+I*20)'
 1320 NEXT
 1330 *FX15,1
 1340 A=INKEY(300)
 1350 RUN
 1360 DEF FNP(A,B)
 1370 PRINT TAB(A,B);
 1380 CALL O%
 1390 =?&70OR224
 1400 DEF PROCbonus
 1410 Y=5
```

(continued on page 189)


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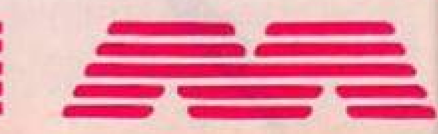
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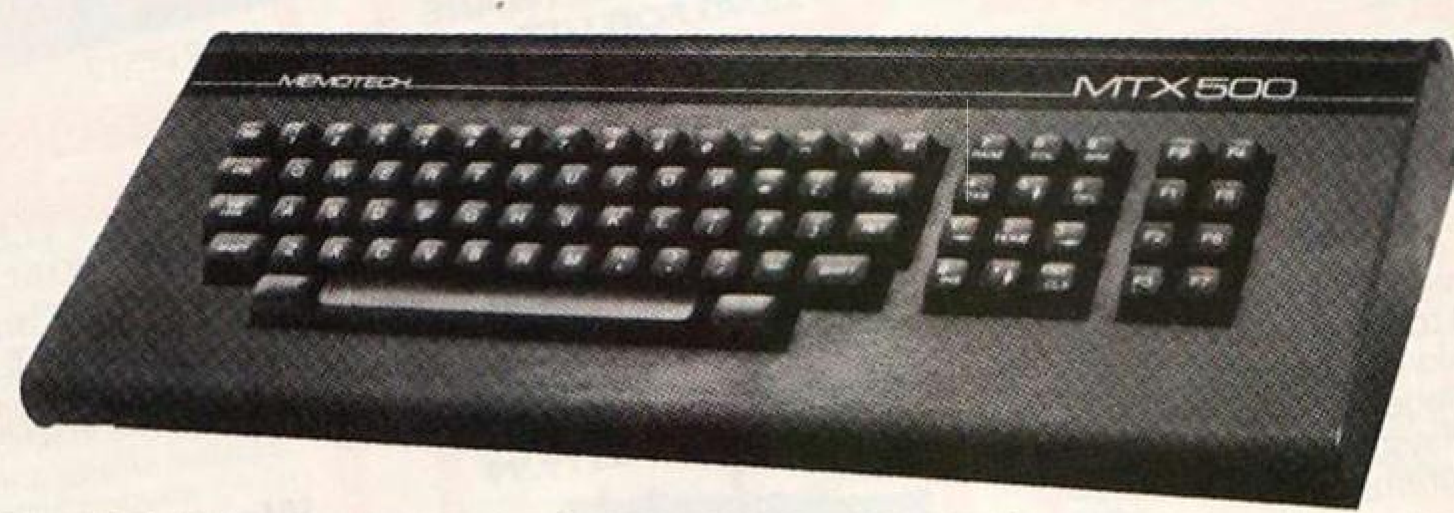
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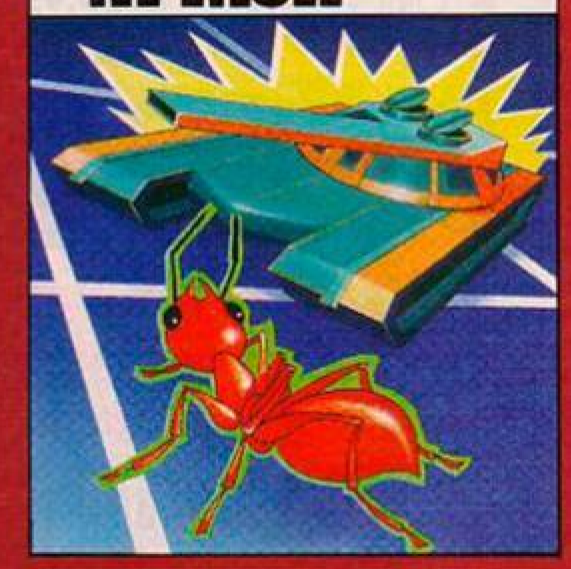


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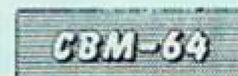


(continued from page 182)

```
1420 STAGE=STAGE+1
1430 SC=SC+STAGE*1000
1440 CLS
1450 PRINT ''"Y O U  H A V E  C O M P L E T E D
                                    S T A G E
";STAGE
1460 PRINT ''"Bonus = ";STAGE*1000
1470 SOUND 3,2,100,50
1480 PRINT '''"Your score =";SC
1490 FOR I=0 TO 500:NEXT
1500 *FX15,1
1510 A=INKEY(300)
1520 CLS
1530 LX=0
1540 ENDPROC
1550 DEF PROChighscore
1560 PRINT ''"This is one of the highest scores today
"
1570 PRINT ''"Well done!"
1580 PRINT ''"Please enter your name.(Max 10 letters.
)"
1590 INPUT A$
1600 IF LEN A$>10 THEN 1590
1610 FOR I=3 TO FL STEP -1
1620 $(HL+I*7+7)=$(HL+I*7)
1630 $(NL+I*20+20)=$(NL+I*20)
1640 NEXT
1650 SC$=STR$(SC)
1660 IF LEN SC$<6 THEN SC$="0"+SC$:GOTO 1660
1670 $(HL+FL*7)=SC$
1680 $(NL+FL*20)=A$
1690 ENDPROC
1700 IF ERR=17 THEN RUN
1710 IF ERR=25 THEN GOTO ERL
1720 MODE7
1730 PRINT ''''
1740 REPORT
1750 PRINT " in line ";ERL
1760 END
1770 DEF PROCDL(A$)
1780 PRINT CHR$141;A$
1790 PRINT CHR$141;A$
1800 ENDPROC
```

Toolkit

Stephen Lockyer,
Abingdon,
Oxfordshire.



THIS IS A toolkit program which defines the function keys, allows a copy of the screen to be dumped to the printer, and allows the listing to be paused by pressing the ← key and then restarted by pressing the Return key. Also a joystick plugged into port 2 can be used to control the cursor in and out of a program. The demo program shows how this makes programming joystick control into a program much easier. The Fire button sends the cursor to the top left of the screen.

The function keys are defined as shown in figure 1. These can easily be changed by altering the Data statements, lines 60 to 70. Putting a ← at the end of the word gives an automatic return when the key is pressed. Each word assigned must not be longer than eight characters.

After running the program you need to activate the toolkit, you do this by typing in:

SYS 156*256

but before you do this make sure you have Saved it as any typing error could cause the computer to crash, and so lose the program.

The machine code will stay in memory until the computer is switched off.

The demonstration program

```
5 SYS156*256:PRINT"♥"
10 SC=1024:CL=55296:X=0:Y=0
20 GETA$:IFA$=""THEN20
30 IFA$="▌"ANDX>0THENX=X-1
40 IFA$="▐"ANDX<39THENX=X+1
50 IFA$="♥"ANDY>0THENY=Y-1
60 IFA$="▒"ANDY<24THENY=Y+1
70 POKESC+X+(Y*40),42:POKECL
+X+(Y*40),1
80 GOTO20
```

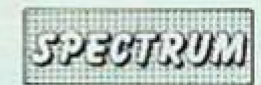
```
10 FORI=0TO19:READK$:K=LEN(K$)
15 FORJ=0TOK-1:W=ASC(MID$(K$,J+1,1))
20 IFW=95 THEN W=13
25 POKE157*256+I*8+J,W
30 NEXTJ
35 FORK=KTO7:POKE157*256+I*8+K,0:NEXTK
40 NEXTI
50 FORI=0TO252:READA:POKE156*256+I,A:NEXT
55 FORI=160TO496:READA:POKE157*256+I,A:NEXT
60 DATALIST,RUN←,INPUT,CHR$(,SAVE,VERIFY←,RESTORE,MID$(
65 DATAREAD,DATA,PEEK(,LEFT$(,GOSUB,RETURN,POKE,RIGHT$(
70 DATAASC(,STR$(,VAL(,TAB(
100 DATA72,138,72,152,72,169,156,133,52,133,56,169,0,133,51,133,55
110 DATA120,169,85,141,20,3,169,156,141,21,3,58
120 DATA162,0,189,50,156,240,8,32,210,255,232,224,255,208,243
130 DATA76,231,156,170,104,96
140 DATA147,32,32,32,32,32,32,32,42,42,42,42,32,67,66,77,32
150 DATA54,52,32,84,79,79,76,75,73,84,32,42,42,42,42,13,13,0
155 DATA72,138,72,152,72,165,197,197,2,208,5,133,2,76,220,157,133,2
160 DATA201,57,208,3,76,220,157,201,7,144,3,76,220,157,201,3
170 DATA176,3,76,220,157,174,141,2,224,4,208,3,76,207,156,201,3
180 DATA240,6,168,136,136,136,135,152,10,10,10,10,10,224,1,208,3,24,105,8
185 DATA224,2,208,3,24,105,16,224,5,208,3,24,105,24,224,6,208,5,74,74,24,105,128
190 DATA133,252,169,157,133,253,160,0,177,252,153,119,2
200 DATA200,192,8,208,246,132,198,104,168,104,170,104,76,49,234
210 DATA201,4,208,3,76,160,157,201,5,208,3,76,176,157
220 DATA201,6,208,3,76,211,158,76,227,158
225 DATA120,169,192,141,40,3,169,157,141,41,3
226 DATA169,4,133,255,88,104,168,104,170,104,96
230 DATA173,32,208,41,15,170,232,138,41,15,141,32,208,76,220,157
240 DATA173,33,208,41,15,170,232,138,41,15,141,33,208,76,220,157
250 DATA165,197,201,57,240,3,76,237,246,165,197,201,1,240,6
260 DATA201,63,240,243,208,244,169,0,133,198,76,237,246
270 DATA173,0,220,201,127,208,3,76,199,156,201,126,208,5,162,145
280 DATA76,22,158,201,125,208,5,162,17,76,22,158,201,123,208,5,162,157
290 DATA76,22,158,201,119,208,5,162,29,76,22,158,201,111,208,5,162,19
300 DATA76,22,158,76,199,156,138,166,255,202,134,255,240,3,76,199,156,162,4
310 DATA134,255,160,1,132,198,141,119,2,76,199,156
320 DATA72,152,72,138,72,120,169,0
330 DATA32,189,255,173,24,208,160,255
340 DATA162,4,41,2,240,2,160,7
350 DATA169,4,32,186,255,32,192,255
360 DATA162,4,32,201,255,176,113,169
370 DATA0,133,251,169,4,133,252,32
380 DATA237,255,134,254,134,253,132,255
390 DATA160,0,169,14,32,210,255,177
400 DATA251,201,128,144,9,41,127,72
410 DATA169,18,32,210,255,104,201,34
420 DATA208,2,169,39,201,32,144,8
430 DATA201,64,144,7,9,128,208,3
440 DATA24,105,64,32,210,255,169,146
450 DATA32,210,255,200,208,2,230,252
460 DATA198,254,208,203,198,255,240,27
470 DATA169,8,32,210,255,169,13,32
480 DATA210,255,169,15,32,210,255,169
490 DATA14,32,210,255,166,253,134,254
500 DATA24,144,172,169,13,32,210,255
510 DATA32,231,255,104,170,104,168,104
520 DATA88,76,220,157
530 DATA169,14,141,106,158,141,183,158
540 DATA169,8,141,168,158,76,47,158
550 DATA169,15,141,106,158,141,183,158
560 DATA141,168,158,76,47,158
```

```
: LIST
: RUN + 
: SAVE
: VERIFY + 
: READ
: DATA
: GOSUB
: RETURN
: INPUT
: RESTORE
: PEEK(
: POKE
  CHR$(
: MID$(
: LEFT$(
  RIGHT$(
: ASC(
: STR$(
: VAL(
  TAB(
: Change Border colour
: Change Background colour
: Copy screen on Printer
(large characters & narrow line spacing)
: Copy screen on Printer
(small characters & normal line spacing)
```

CBM-64 Toolkit figure 1.

Music maker

Nick Carter,
London NW1.



EASY ENTRY OF MELODIES using simple cursor controls is possible with this program. Thus calculation of Beep values is avoided. Several facilities are included, enabling editing, transposition and Saving and Loading on tape.

On running the program, the display will appear and in order to enter a note, the following procedure should be followed. Firstly, in order to enter the pitch of the note, use the cursor control keys 6 and 7 — without Caps Shift — to move the note which will have appeared on the middle ledger line up or down as required. Then, when it is in the desired position, press the Enter key to fix that note in the memory.

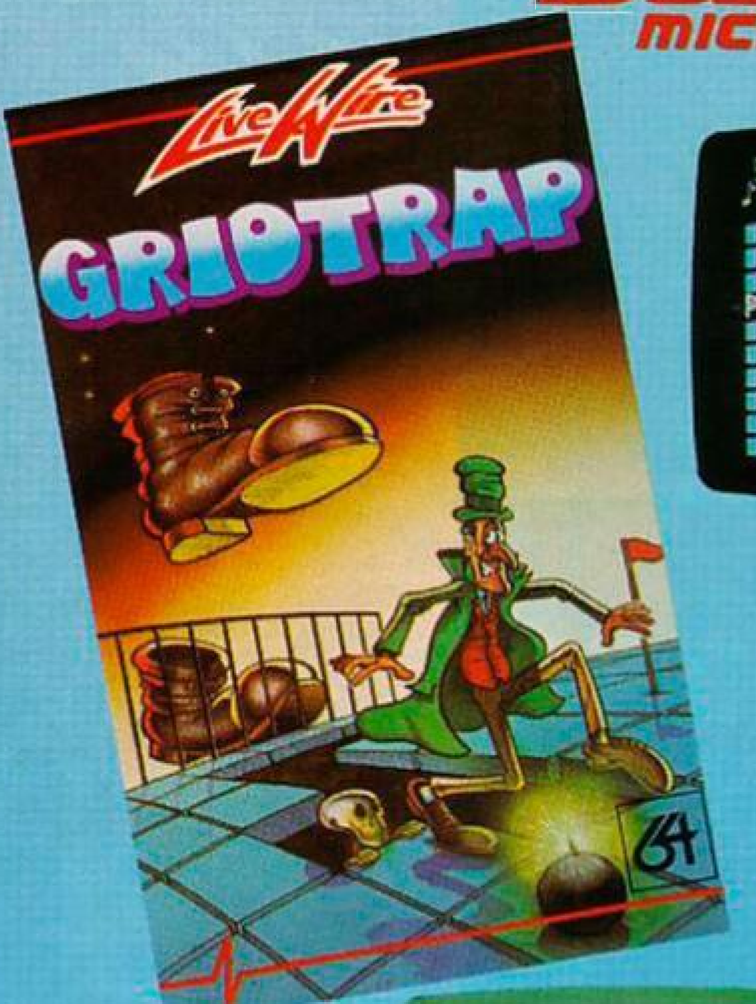
A prompt will then appear, enquiring whether this note is a flat, sharp, or natural or whether you do not require a note but a rest instead. You should reply with the first letter of the relevant word except in the case of a natural where for convenience any key except f, s or r will do, the Enter key being the best choice.

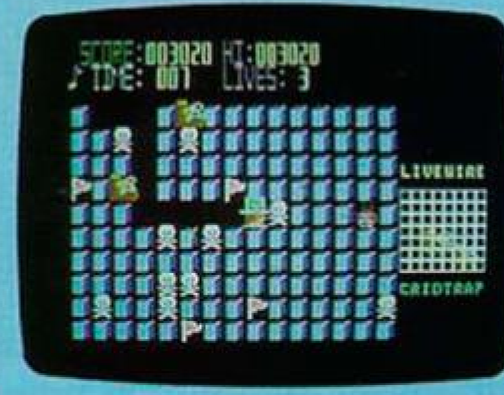
On answering the prompt, an arrow will appear below the crotchet in the row of notes in the top right-hand corner of the screen. This can be moved right or left, again using the cursor control keys — this time 5 and 8 — and, when the Enter key is pressed, the duration of the note printed will be stored in memory. The computer then returns to the pitch entry routine, ready to repeat the process or to accept any of the commands listed on the screen. The procedure for each of these is as

(continued on page 193)

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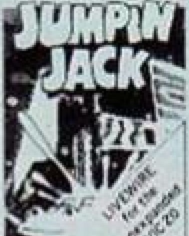
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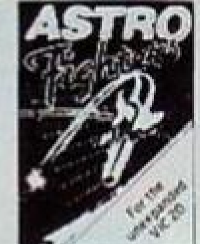


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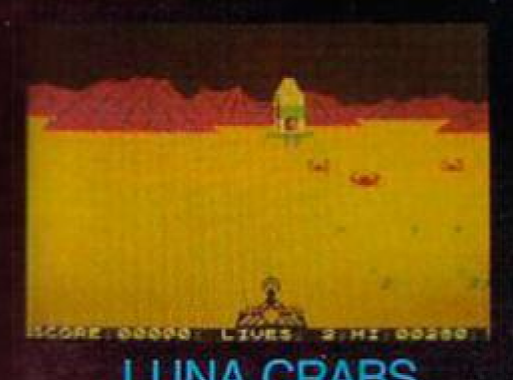
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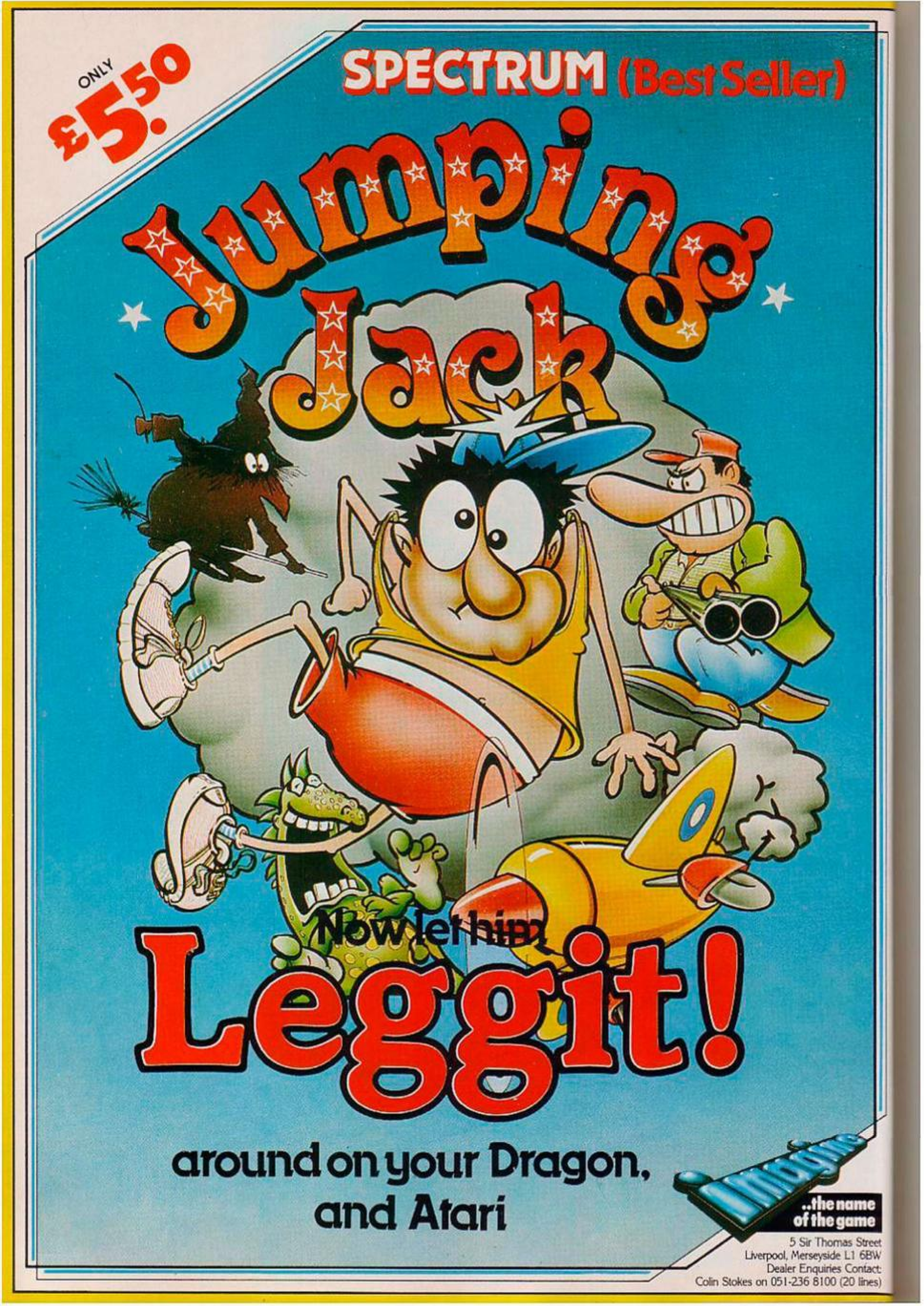


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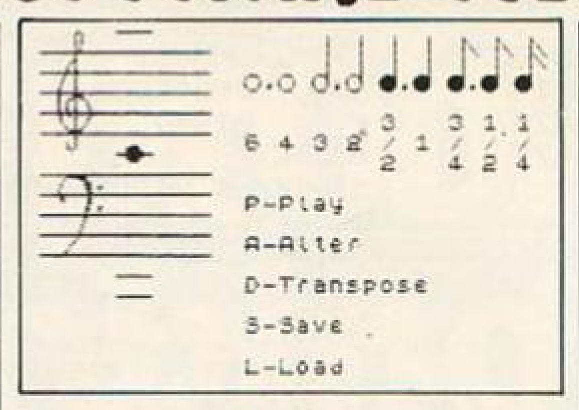
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(continued from page 189)

follows:

■Play — A prompt will appear asking the speed in crotchet beats per minute. As a very rough guide, the following may help: Largo/Adagio — Slow (40-75); Andante/Moderato — Moderately (75-120); Allegro — Fast (120-170); Presto — Very fast (170-210). Obviously, this depends very much on the piece in question, so experimenting may prove to be the best method.

■Alter — A prompt will appear asking for the number of the note in the tune to be altered. When this has been answered, the Editing message will indicate that the new note can be entered — in the same way as any other — but in this case it will overwrite the incorrect note. The computer will then return to the pitch entry routine so that the next note entered will be added to the end of the melody.



■Transpose — A prompt will ask the required change in semitones — the answer to which should be a positive or negative integer. If the transposition is possible, control will be returned to the pitch entry routine, otherwise the prompt will re-appear. Entering 0 will leave the tune unaffected.

■Save — This will run the Play routine. When the tune has finished playing, press any key and, in reply to the prompt, enter the name of the tune. Follow the commands to Save the bytes and then, after the OK message, rewind the tape and play it so that the bytes can be verified.

■Load — This will load the first bytes on the tape and then pass control to the pitch entry routine, so that the next note entered will be added to the end of the new melody.

The program is written for a 16K Spectrum with a maximum tune length of roughly 50 notes, requiring 100 bytes of storage space. In order to use the program on a 48K machine, or to have tunes in excess of 50 notes, the following lines will have to be changed: 50, 60, 505, 615, 715, 730, 815, 855,860. If required, the delay time — specified by the maximum value of F in line 1000 — can be shortened to speed up entry, but the purpose of this is to prevent one key-press being read by two consecutive subroutines, so beware!



```
  10 REM Music © N.P.Carter 1983
  50 CLEAR 32499
  55 DIM n(9): DIM d(9)
  60 LET x=23: LET t=32500
  65 LET m=0: LET l=8
 100 FOR i=144 TO 164
 105 FOR j=0 TO 7
 110 READ k: POKE USR CHR$ i+j,k
 115 NEXT j
 120 NEXT i
 125 DATA 96,144,144,144,144,144
,160,160
 130 DATA 0,0,0,1,2,4,8,8
 135 DATA 0,128,128,128,128,128,
128,128
 140 DATA 0,16,32,32,64,64,128,1
28
 145 DATA 0,129,130,132,136,136,
136,136
 150 DATA 0,224,152,132,130,130,
129,129
 155 DATA 0,68,64,64,32,16,8,7
 160 DATA 0,129,130,130,132,136,
144,224
 165 DATA 0,0,0,0,8,8,5,2
 170 DATA 0,128,128,128,128,128,
0,0
 175 DATA 0,15,16,32,64,64,128,1
28
 180 DATA 0,248,60,14,7,7,7,3
 185 DATA 0,96,112,32,0,0,0,0
 190 DATA 0,3,3,3,2,6,6,4
 195 DATA 0,12,8,8,16,16,32,32
 200 DATA 0,0,0,1,2,4,8,16
 205 DATA 0,64,128,0,0,0,0,0
 210 DATA 0,60,126,255,255,255,1
26,60
 215 DATA 0,0,0,0,0,60,126,255
 220 DATA 0,255,126,60,0,0,0,0
 225 DATA 0,60,66,129,129,129,66
,60
 250 FOR i=3 TO 9
 255 READ k: LET n(i)=k
 260 NEXT i
 265 DATA 11,9,7,5,4,2,0
 270 FOR i=1 TO 9
 275 READ k: LET d(i)=k
 280 NEXT i
 285 DATA 24,16,12,8,6,4,3,2,1
 290 GO SUB 900
 300 IF INT l=l THEN PRINT AT l,
6;"▬";AT l-1,6;"▲"
 305 IF INT l<>l THEN PRINT AT I
NT l,6;"●"
 310 IF INKEY$="" THEN GO TO 310
 315 LET c=CODE INKEY$
 320 IF m=1 THEN GO TO 350
 325 IF c=112 THEN GO SUB 500
 330 IF c=97 THEN GO SUB 600
 335 IF c=100 THEN GO SUB 700
 340 IF c=115 THEN GO TO 800
 345 IF c=108 THEN GO TO 850
 350 IF c=13 THEN GO SUB 400: IF
 m=1 THEN RETURN
 355 IF c<>54 AND c<>55 THEN GO
TO 310
 360 IF INT l=l THEN PRINT AT l,
6;"▬";AT l-1,6;"▲"
 365 IF INT l<>l THEN PRINT AT I
NT l,6;"●"
 370 LET l=l+.5*((c=54 AND l<15)
-(c=55 AND l>1.5))
 375 GO TO 300
 400 GO SUB 1000
 405 PRINT AT 21,0;"Flat,sharp,n
atural or rest?"
 410 IF INKEY$="" THEN GO TO 410
 415 PRINT AT 21,0;"Flat,sharp,n
atural or rest?"
 420 LET c=CODE INKEY$
 425 IF c=114 THEN POKE t+1,99:
GO TO 445
 430 LET z=l: LET o=0
 435 IF z>4.5 THEN LET z=z-3.5:
LET o=o+1: GO TO 435
 440 POKE t+1,((3-o)*12+n(z*2)+(
c=115)-(c=102))
 445 GO SUB 1000
 450 PRINT AT 5,x;"↑"
 455 IF INKEY$="" THEN GO TO 455
 460 LET c=CODE INKEY$
 465 IF c<>56 AND c<>53 AND c<>1
3 THEN GO TO 455
 470 PRINT AT 5,x;"↑"
 475 IF c=13 THEN POKE t,d((x-11
)/2): LET t=t+2: GO SUB 1000: RE
TURN
 480 LET x=x+(c=56 AND x<29)-(c=
53 AND x>13)
 485 GO TO 450
 500 POKE t,0: POKE t+1,99
 505 LET i=32500
 510 INPUT "Beats per minute?";b
: LET s=15/b
 515 BEEP s*PEEK i,PEEK (i+1)-24
: LET i=i+2: GO TO 515+(PEEK (i+
1)=99)
 516 PAUSE 50*s*PEEK i: LET i=i+
2: GO TO 515+2*(PEEK (i-2)=0)
 517 RETURN
 600 INPUT "Which note to be alt
ered?";n
 605 GO SUB 1000
 610 LET v=t
 615 LET t=32498+2*n: LET m=1
 620 PRINT AT 18,0;"Editing"
 625 GO SUB 310
 630 PRINT AT 18,0;"Editing"
 635 LET m=0
 640 LET t=v
 645 LET c=0
 650 RETURN
 700 INPUT "Change in pitch in s
emitones";y
 705 GO SUB 1000
 710 IF INT y<>y THEN GO TO 700
 715 LET i=32501
 720 IF PEEK i+y>93 OR PEEK i+y<
0 THEN GO TO 700
 725 IF i<t-1 THEN LET i=i+2: GO
 TO 720
 730 FOR i=32501 TO t-1 STEP 2
 735 POKE i,PEEK i+y
 740 NEXT i
 745 RETURN
 800 GO SUB 500
 805 INPUT "Name?";a$
 810 CLS
 815 SAVE a$CODE 32500,t-32500
 820 VERIFY a$CODE
 825 RUN
 850 CLS
 855 LOAD ""CODE 32500
 860 LET t=32500
 865 IF PEEK t=0 AND PEEK (t+1)=
99 THEN GO TO 290
 870 LET t=t+2: GO TO 865
 900 OVER 0: CLS
 905 FOR a=71 TO 119 STEP 48
 910 FOR i=a TO a+32 STEP 8
 915 PLOT 8,i: DRAW 80,0
 920 NEXT i
 925 NEXT a
 930 FOR i=55 TO 159 STEP 8
 935 PLOT 44,i: DRAW 16,0
 940 NEXT i
 945 OVER 1
 950 PRINT AT 2,3;"";AT 3,2;"";AT 3,3;"";AT 4,2;"";AT 4,3;"";AT 5,2;"";AT 5,3;"";AT 6,2;"";AT 6,3;"";AT 7,2;"";AT 7,3;""
 955 PRINT AT 9,2;"";AT 9,3;"";AT 10,2;"";AT 10,3;"";AT 11,3;"";AT 12,2;"";AT 12,3;"";AT 9,4;"";AT 10,4;""
 960 PRINT AT 4,13;"O.O O.O ●.●
●.● ●"
 965 FOR i=0 TO 96 STEP 16
 970 PLOT 143+i,141: DRAW 0,16
 975 IF i>63 THEN DRAW 7,-7: IF
i>95 THEN PLOT 240,151: DRAW 6,-
6
 980 NEXT i
 985 PRINT AT 6,21;"3   3 1 1";A
T 7,13;"6 4 3 2 / 1 / / /";AT 8,
21;"2   4 2 4"
 990 PRINT AT 10,13;"P-Play";AT
12,13;"A-Alter";AT 14,13;"D-Tran
spose";AT 16,13;"S-Save";AT 18,1
3;"L-Load"
 995 RETURN
1000 FOR f=1 TO 50: NEXT f: RETU
RN
```

Dynvars

Alan Wagstaff,
Richmond,
North Yorkshire.



THIS ASSEMBLY language program produces a machine-code routine starting at D01 hex. The code, when called, prints the names of all dynamic variables used by a Basic program.

To use it, enter the listing and Run it. Then enter the Basic program and Run it. Entering

CALL &D01

will list the Basic programs variables.

```
10FORF%=0TO1
20P%=&D01
30[OPT F%*2
40     LDA#65
50     STA&75
60     LDA#&82
70     STA&70
80     LDA#4
90     STA&71
100.L  LDY#1
110    LDA(&70),Y
120    BEQ N
130    STA&81
140    LDY#0
150    LDA(&70),Y
160    STA&80
170.Q  LDA#13
180    JSR&FFE3
190    LDA&75
200    JSR&FFE3
210    LDY#2
220.M  LDA(&80),Y
230    BEQ R
240    JSR&FFE3
250    INY
260    CLC
270    BCC M
280.R  LDY#1
290    LDA(&80),Y
300    BEQ N
310    TAX
320    DEY
330    LDA(&80),Y
340    STA&80
350    STX&81
```

(continued on next page)

(continued from previous page)

```
360   CLC            410   CMP#&F6        470.Z LDA#13
370   BCC Q          420   BEQ Z          480   JSR&FFE3
380.N LDA#2          430   STA&70         490   RTS:]
390   CLC            440   INC&75         500NEXT
400   ADC&70         450   CLC            510REM A WAGSTAFF
                     460   BCC L          520REM    1983
```

Wordsearch

Lee Butchart, Whitchurch, Bristol.



ANY SPECTRUM can be used in this program to generate random Wordsearches — the puzzle in which you have to try and find words hidden within a grid.

The size of the grid in this program is 20 by 20 — letters. You enter 10 words into the Spectrum which can be a maximum of 10 letters in length each. Then the Spectrum will generate a Wordsearch using your words.

When the grid appears, your words will be printed next to the grid. There will also be a Menu:

- *Answers* — Will you give the answers.
- *Quit* — Will quite the Program.
- *Copy* — Will copy grid and words to printer.
- *Restart* — Allows you to enter new words, and hence a new wordsearch.
- *Shuffle* — Generates a new Wordsearch, but uses the same words currently in use.

```
   0>REM  WORDSEARCH GENERATOR
       BY LEE.BUTCHART  ©1983

   5 REM     INTRODUCTION

  10 PAPER 0: INK 7: BRIGHT 1: B
ORDER 0: CLS
  20 LET a$="      WORDSEARCH GE
NERATOR        ": FOR a=1 TO 31: P
RINT AT 0,0;a$(32-a TO ): BEEP .
01,0: NEXT a: LET A$="
    BY                 ": FOR A=1
 TO 31: PRINT AT 1,0;a$(32-a TO
): BEEP .01,0: NEXT a
  30 LET A$="          LEE.BUTCHA
RT          ": FOR A=1 TO 31: P
RINT AT 2,0;A$(32-A TO ): BEEP .
01,0: NEXT A
  40 FOR A=1 TO 1000: NEXT A: CL
S
  50 POKE 23658,255
  55 REM   BRIEF INSTRUCTIONS

  60 PRINT AT 0,0;
  70 PRINT TAB 6; PAPER 1;"WORDS
EARCH GENERATOR"; PAPER 0;TAB 6;
 INK 6;"[redacted]"
  80 PRINT : PRINT "This program
 will generate a   20x20 grid o
f letters with 10   words hidden
 in it.You input    the words an
d the Spectrum will hide them,pr
int the grid on the screen,and i
f required-on the   printer.It w
ill also show you   where the wo
rds are."
  90 PRINT : PRINT TAB 8;"Press
Any Key"
 100 IF INKEY$="" THEN GO TO 100
 110 CLS
 115 REM    INPUT SECTION

 120 PRINT AT 20,0;"Please enter
 your 10 words.      Press ENTER
after each."
 130 DIM a$(10,10)
 140 FOR a=1 TO 10
 150 INPUT "Word ";(a);"=";b$: C
LS : IF LEN b$>10 THEN PRINT "MA
XIMUM OF 10 LETTERS PLEASE!": GO
 TO 150
 160 IF b$="" THEN GO TO 150
 170 LET a$(a)=b$: NEXT A: CLS
 180 PRINT AT 7,9; PAPER 1;"PLEA
SE WAIT"
 185 REM
          MAIN ROUTINE

 190 DIM g$(20,20): DIM c(20,20)
: DIM x(10): DIM y(10)
 200 FOR a=1 TO 10
 210 FOR b=1 TO 10: IF a$(a,b TO
b)<>" " THEN NEXT b
 220 LET B=B-1
 230 LET X(A)=INT (RND*20)+1: LE
T Y(A)=INT (RND*20)+1
 235 REM
        FIND WHICH DIRECTIONS
  THE WORD CAN/CANNOT GO IN.
 240 LET d$="": LET xx=x(a): LET
 yy=y(a)
 250 LET d$=d$+("1" AND yy+b<21)
+("2" AND yy+b<21 AND xx>b)+("3"
 AND xx>b)+("4" AND xx>b AND yy>
b)+("5" AND yy>b)+("6" AND yy>b
AND xx+b<21)+("7" AND xx+b<21)+(
"8" AND xx+b<21 AND yy+b<21)
 260 LET d=VAL (d$(INT (RND*(LEN
 d$)+1)))
 265 REM
        CHECK FOR 'OVERWRITING'
  AND PUT WORD INTO THE GRID

 270 FOR c=1 TO b: IF g$(xx,yy)=
" " THEN LET xx=xx-(d>1 AND d<5)
+(d>5 AND d<9): LET yy=yy-(d>3 A
ND d<7)+(d<3 OR d=8): NEXT c: GO
 TO 290
 280 GO TO 230
 290 LET ink=INT (RND*4)+4: LET
xx=x(a): LET yy=y(a): FOR c=1 TO
 b: LET g$(xx,yy)=a$(a,c): LET c
(xx,yy)=ink: LET xx=xx-(d>1 AND
d<5)+(d>5 AND d<9): LET yy=yy-(d
>3 AND d<7)+(d<3 OR d=8): NEXT c
 300 NEXT A: CLS
 305 REM
        END OF MAIN LOOP
    NOW WE FILL IN ALL BLANK
    SPACES WITH RANDOM LETTERS

 310 FOR A=1 TO 20: FOR B=1 TO 2
0: IF G$(A,B)=" " THEN LET G$(A,
B)=CHR$ (64+(INT (RND*26)+1))
 320 NEXT B: NEXT A
 325 REM
        PRINT GRID AND WORDS

 330 PLOT 174,174: DRAW -4,-4: P
LOT 174,1: DRAW -4,4: PLOT 1,1:
DRAW 4,4: PLOT 1,174: DRAW 4,-4:
 PLOT 5,5: DRAW 0,165: DRAW 165,
0: DRAW 0,-165: DRAW -165,0: PLO
T 1,1: DRAW 0,173: DRAW 173,0: D
RAW 0,-173: DRAW -173,0
 340 FOR A=1 TO 20: PRINT AT A,1
;G$(A): NEXT A
 350 FOR A=1 TO 10: PRINT AT A,2
2; INK 6;A$(A): NEXT A
 355 REM
        PRINT THE MENU

 360 PRINT AT 14,22; PAPER 2;" M
ENU "
 370 PRINT AT 15,22;"A=ANSWERS"
 380 PRINT AT 17,22;"C=COPY"
 390 PRINT AT 16,22;"Q=QUIT"
 400 PRINT AT 18,22;"R=RESTART"
 401 PRINT AT 19,22;"S=SHUFFLE"
 405 REM
        OPERATE THE MENU

 410 IF INKEY$="C" THEN FOR A=14
 TO 19: PRINT AT A,22;"
": NEXT A: COPY : GO TO 360
 420 IF INKEY$="R" THEN RUN 120
 430 IF INKEY$="Q" THEN CLS : ST
OP
 435 IF INKEY$="S" THEN CLS : PR
INT AT 6,10; FLASH 1; PAPER 2;"S
HUFFLING": GO TO 180
 440 IF INKEY$<>"A" THEN GO TO 4
10
 450 FOR A=20 TO 1 STEP -1: PRIN
T AT A,1; INK 2;G$(A): NEXT A
 460 FOR A=1 TO 20: FOR B=1 TO 2
0: IF C(B,A)>2 THEN PRINT AT B,A
; OVER 1; INK C(B,A);" "
 470 NEXT B: NEXT A
 480 PRINT #1;"Any Key To Return
To Normal Grid": PAUSE 1: PAUSE
0: INPUT ""
 490 GO TO 340
```

Bomber

Paul King, Ipswich, Suffolk.



HAVING SEEN several listings over the past few months for Bomber-type programs for just about every computer apart from the Oric, I thought that it was time that this situation was remedied, and so, herewith, Oric-Bomber.

There is nothing spectacularly different about this program. As usual, the game consists of demolishing a city to provide a landing site for your aircraft and, should you succeed, having a new city to demolish this time with higher skyscrapers. There is a limit to the number of bombs you carry. This is set by variable BL in line 1130.

For those of you with cats, grannies or wives of a nervous disposition, I would suggest that line 2070 is modified as follows:

2070 POKE C-40,3: POKE C,124

This will eliminate the explosion caused by a bomb hitting a building.

I have written the program as a series of subroutines labelled with Rem statements so that the operation of the program can be easily understood and modifications readily made where desired.

For those of you who have played this game before, I would suggest that you omit line 35 from the listing together with lines 4000 to 4150. This should save you considerable typing-in time.

```
20 PAPER0:INK3
30 PRINTCHR$(17);CHR$(20);CHR$(6);CHR$(12)
35 GOSUB4000
40 GOSUB1000
50 GOSUB1100
60 GOSUB2000
70 IF WIN THENGOTO40
80 GOSUB3000
100 GOTO40
1000 REM*******************************
1001 REM     DEFINE CHARACTERS
1002 REM*******************************
1003 RESTORE
1010 FORY=1TO4:READW
1020 FORZ=0TO7
1030 READX
1040 POKEW+Z,X
1050 NEXTZ
```

(continued on page 196)

(continued from page 194)

```
1060 NEXTY
1070 DATA47072,92,92,72,92,126,126,92,72,46376,64,64,6
4,92,126,67,1
26,64
1071 DATA46384,64,64,112,120,95,94,79,64,46592,119,127
,93,85,95,93,
117,127
1099 RETURN
1100 REM******************************
1101 REM              SETUP
1102 REM******************************
1110 PRINTCHR$(12)
1120 WIN=FALSE
1130 BL=40:B=0
1140 PLOT0,25,20:PLOT1,25,"=========================
=========="
1150 FORZ=24TO15-SC STEP-1
1160 FORY=1TO38
1170 X=INT(RND(1)*(5+SC))+1
1180 IFSCRN(Y,Z+1)<>32ANDX>1THENPLOTY,Z,"@"
1190 NEXTY:NEXTZ
1200 PLOT0,1,1: PRINT" SCREEN: ";SC+1;SPC(12)"BOMBS LE
FT: ";BL
1210 PLOT9,1,2:PLOT35,1,2:PLOT12,1,1
1999 RETURN
2000 REM******************************
2001 REM              PLAY
2002 REM******************************
2010 A=48160
2020 POKEA+2,37:POKEA+1,38:POKEA,5
2030 IFB=1THENGOTO2070
2040 IFKEY$=""THENGOTO2100
2050 B=1:BL=BL-1:IFBL<0THENGOTO2100
2055 BL$=STR$(BL): PLOT36,1,"   ":PLOT36,1,BL$
2060 C=A
2070 POKEC-40,3: POKEC,124:IF PEEK(C+40)=64 THEN EXPLO
DE
2080 C=C+40:IFC>49040THENB=0
2090 IFB=0THENPOKEC-40,3
2100 A=A+1:IFPEEK(A+2)=64THENGOTO2130
2110 IFA<>49020THENGOTO2020
2120 SC=SC+1:WIN=TRUE
2130 RETURN
3000 REM******************************
3001 REM              END-GAME
3002 REM******************************
3010 EXPLODE
3015 SC=0
3020 POKEA+1,38:POKEA,3:POKEA+2,32
3030 A=A+41
3040 REPEAT
3050 POKEA,38:POKEA-40,3
3060 LETA=A+40
3070 UNTILA>49040
3080 PLOT2,10,12:PLOT3,10,1:PLOT4,10,"PRESS ANY KEY FO
R ANOTHER GAM
E"
3090 GETX$
3999 RETURN
4000 REM******************************
4001 REM        INSTRUCTIONS
4002 REM******************************
4010 PLOT14,1,19:PLOT14,2,19:PLOT24,1,16:PLOT24,2,16
4020 PLOT13,1,4:PLOT13,2,4:PLOT12,1,10:PLOT12,2,10
4030 PLOT16,1,"BOMBER":PLOT16,2,"BOMBER"
4040 PLOT13,5,"INSTRUCTIONS":PLOT12,5,1
4050 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
4060 PRINT"    Your mission is to bomb the city "
4070 PRINT:PRINT" to provide yourself with a suitable"
4080 PRINT:PRINT" landing site.   Should you achieve"
4090 PRINT:PRINT" this, a more difficult screen will"
4100 PRINT:PRINT" be presented.   You have a limited "
4110 PRINT:PRINT" number of bombs so don't be wasteful
."
4120 PRINT:PRINT"    Press any key to drop bombs."
4130 PLOT5,24,1:PLOT6,24,"PRESS ANY KEY TO CONTINUE"
4140 GETZ$
4150 RETURN
```

Colour change

Elloit Gingold,
Watford,
Herfordshire.



ONE FEATURE OF computers such as the BBC that is often admired by Spectrum owners is the ability to change colours of objects already on the screen. Thus using the BBC command VDU19 one is able to, say, change all the blue objects to red instanteously. Such a command also allows one to draw a complicated diagram in an "invisible" colour and then, by redefinition of the colours, make it suddenly appear in its full completion.

The Spectrum, of course, has no such feature. It is possible to do a colour change from Basic by Over 1 Printing an empty string 704 spaces long but this is rather slow and produces a display with a single colour Ink or Paper. But the organisation of the Spectrum attribute file makes almost instanteous Ink or Paper changes of specific types easy to achieve with simple machine-code routines.

The attribute file consists of 768 bytes corresponding to the positions on the screen. Each byte controls the colour of the 8 by 8 pixel square as shown:

```
BIT  7  6  5  4  3  2  1  0
            PAPER     INK
```

Thus Bits 0 to 2 hold a number from 0 to 7 corresponding to the set Ink colour with a similiar situation for bits 3 to 5 and Paper colour. To change all blue Ink to red all that is needed is to move through the 768 bytes, check bits 0-2 for the prescence of the code 1, and if this is found change it to 2. A similar look at bits 3-5 will effect selective Paper changes.

The program actually consists of three short routines that act in this way. In addition to Ink and Paper changing I have included a routine that will swap any two nominated Ink colours. This final routine is useful in producing a variety of flashing affects. Note that in the listing any pound signs should be replaced with #.

Once you have typed the program in as far as line 110 I would suggest running it to see if the checksum works — this is the variable cs. If there is no error reported you have probably made no mistakes in the Data lines. You could then Save the machine code for later use. use

SAVE "colour" CODE 65000,122

You had better Save the Basic listing as well just in case. The rest of the program just demonstrates the use of these new functions, I hope that readers will come up with better applications.

The main points to note are that the colour to be replaced is Poked into location 65000 and the new colour Poked into 65001. If you wish to change Ink colour call USR 65002, or if it is the paper you want to alter call USR 65031. The Ink Swap routine is obtained from USR 65078. To achieve a flashing effect, it is called from within a loop, the length of any Pause command determining the flash rate. Try having one of the two colours the same as the Paper; this produces a rather more sedate affect than that in the demonstration program.

The program was written on a 48K Spectrum but, with a few changes, the routines can be relocated anywhere. I have included a loader program for a 16K machine, in this case the mahine code goes in at 32000. The details of use are the same except all relevant locations start with 32 rather than 65 i.e., 65031 becomes 32031. Do not forget to Clear 64999 — or 31999 — before loading the code in future applications.

```
   5 REM Loader and demo for 48K
  10 DATA 0,0,33,0,88,62,91,188,200,126,230,7,71,58,23
2,253
  20 DATA 184,32,9,126,230,248,71,58,233,253,128,119,3
5,24,230
  30 DATA 33,0,88,58,232,253,23,23,23,50,232,253,58,23
3,253,23,23,23
  40 DATA 50,233,253,62,91,188,200,126,230,56,71,58,23
2,253,184
  50 DATA 32,9,126,230,199,71,58,233,253,128,119,35,24
,230
  60 DATA 33,0,88,62,91,188,200,126,230,7,71,58,232,25
3,184,40,15
  70 DATA 58,233,253,184,32,18,126,230,248,71,58,232,2
53,24,7,126,230
  80 DATA 248,71,58,233,253,128,119,35,24,215
  90 CLEAR 64999: LET cs=0
 100 FOR f=65000 TO 65121: READ a: POKE f,a: LET cs=cs
+a: NEXT f
 110 IF cs<>15179 THEN PRINT "Error in data": STOP
 120 REM Demo Program
 130 FOR f=1 TO 44: PRINT INK 7*RND; PAPER 7*RND;" Thi
s is a demo ";: NEXT f
 140 PRINT £1;AT 0,0;"To change ink press 0, To change
paper press 1, Next demo press 2"
 145 IF INKEY$<>"" THEN GO TO 145
 150 LET r$=INKEY$: LET r=CODE r$: IF r<48 OR r>50 THE
N GO TO 150
 155 IF r=50 THEN GO TO 300
 160 INPUT "": PRINT £1;"Press 0 to 7 for old colour"
 165 IF INKEY$<>"" THEN GO TO 165
 170 LET o$=INKEY$: LET o=CODE o$: IF o<48 OR o>55 THE
N GO TO 170
 180 INPUT "": PRINT £1;"Press 0 to 7 for new colour"
 185 IF INKEY$<>"" THEN GO TO 185
```

(continued on page 201)


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(continued from page 196)

```
 190 LET n$=INKEY$: LET n=CODE n$: IF n<48 OR n>55 THE
N GO TO 190
 200 INPUT "": LET o=o-48: LET n=n-48: POKE 65000,o: P
OKE 65001,n
 210 IF r=48 THEN RANDOMIZE USR 65002
 220 IF r=49 THEN RANDOMIZE USR 65031
 230 GO TO 140
 300 PAPER 0: BORDER 0
 310 CLS
 320 FOR f=0 TO 21
 330 PRINT AT f,f; INK 2;"HELLO "; INK 6;"THERE"
 340 NEXT f
 350 POKE 65000,2: POKE 65001,6
 360 RANDOMIZE USR 65078
 370 PAUSE 10
 380 GO TO 360

   5 REM Loader for 16K
  10 DATA 0,0,33,0,88,62,91,188,200,126,230,7,71,58,0,
125
  20 DATA 184,32,9,126,230,248,71,58,1,125,128,119,35,
24,230
  30 DATA 33,0,88,58,0,125,23,23,23,50,0,125,58,1,125,
23,23,23
  40 DATA 50,1,125,62,91,188,200,126,230,56,71,58,0,12
5,184
  50 DATA 32,9,126,230,199,71,58,1,125,128,119,35,24,2
30
  60 DATA 33,0,88,62,91,188,200,126,230,7,71,58,0,125,
184,40,15
  70 DATA 58,1,125,184,32,18,126,230,248,71,58,0,125,2
4,7,126,230
  80 DATA 248,71,58,1,125,128,119,35,24,215
  90 CLEAR 32999: LET cs=0
 100 FOR f=32000 TO 32121: READ a: POKE f,a: LET cs=cs
+a: NEXT f
 110 IF cs<>10859 THEN PRINT "Error in data": STOP
 120 REM For rest of program use 48K version with 32xx
x in place of 65xxx
```

Line delete

VIC-20 / CBM-64

Richard Morton,
Sutton Coldfield,
West Midlands.

THIS PROGRAM WILL work on the Vic-20 — any memory — and the Commodore 64.

Delete will delete all lines between the two you specify — including those two — but is rather slow as it must check every line number.

Auto run prints the line number at the top of the screen and you can then type in the line as normal, ending with Return.

The Sys — 65487 — in line 63130 gets characters from the keyboard and prints them on the screen with a flashing cursor.

```
62999 STOP
63000 POKE36879,27:PRINT"■":PRINT"■■AUTO NUMBER ■N":PRINT
"DELETE       ■D":PRINT"FINISH        ■F"
63010 GETA$:IFA$<>"N"ANDA$<>"D"ANDA$<>"F"THEN63010
63020 PRINT"■■":IFA$="N"THEN63100
63030 IFA$="F"THENEND
63040 INPUT"FROM";A:INPUT"TO  ";B:PRINT"■"
63050 IFA<0ORB<0ORA>62999ORB>62999THEN63020
63060 IFA>BTHEN63000
63070 PRINT"■■"A
63080 PRINT"■A="A+1":B="B":GOTO63060
63090 POKE198,3:POKE631,19:POKE632,13:POKE633,13:END
63100 INPUT"START     ";A:INPUT"INCREMENT";B:IFA<0ORB<1ORA>
62999ORB>62999THEN63020
63110 IFA>62999THEN63000
63120 PRINT"■■"A;
63130 SYS(65487):PRINT
63160 PRINT"■A="A+B":B="B":GOTO63110"
63170 POKE198,3:POKE631,19:POKE632,13:POKE633,13:END
```

Cassette labels

ZX-81

A N Gandy,
Leamington Spa,
Warwickshire.

CASSETTE LABELS uses the ZX printer to produce neat, uniform, cassette sleeves simply and quickly. The printer paper is exactly the right width to fit a standard cassette box. The completed label displays the title on the spine, centralised in a surrounding box. If the title is less than 25 characters long, a sub-title can also be displayed.

Operating notes or other text may then be entered directly to the screen and subsequently copied to the printer to form pages of information, each page being separated by a fold line.

The text entry may be of particular interest as it uses a machine-code routine to provide full screen entry, with a flashing cursor which may be moved using the arrowed keys 5, 6, 7, 8. The cursor movements, and the erase, will auto-repeat. Speed of repeat may be altered at location 16756. When each page has been completed, enter shifted A(stop) to return to Basic which will copy the screen to the printer. All printable characters, but no graphics, are available from the keyboard.

Entering the program is straightforward but will require a suitable loader to Poke the values shown into a Rem statement 280 characters long in line 1. Decimal values have been given since, although entry is slower than in hex, confusion between 'B' and '8' is avoided.

```
   4■REM
   5 CLS
  10 PRINT "ENTER TITLE"
  20 INPUT A$
  30 IF LEN A$<25 THEN GOTO 110
  40 IF LEN A$>50 THEN GOTO 5
  50 FOR N=26 TO 1 STEP -1
  60 IF CODE A$(N)=0 THEN GOTO 8
0
  70 NEXT N
  80 LET B$=A$((N+1) TO )
  90 LET A$=A$( TO N)
 100 GOTO 190
 110 PRINT AT 10,0;"ENTER SUB-TI
TLE"
 120 INPUT B$
 130 IF LEN B$<25 THEN GOTO 190
 140 CLS
 150 PRINT AT 5,0;"TOO LONG, PLE
ASE RE-ENTER"
 160 GOTO 120
 200 LPRINT
 202 LPRINT
 203 LPRINT
 204 LPRINT TAB 5;"SINCLAIR ZX81
 PROGRAM"
 205 LPRINT
 206 LPRINT
 207 LPRINT
 208 LPRINT "■■■■■■■■■■■■■■■■■■■■■
■■■■■■■■■■■"
 209 LPRINT "■";TAB (16-LEN A$/2
);A$;TAB 31;"■"
 210 LPRINT "■";TAB (16-LEN B$/2
);B$;TAB 31;"■"
 211 LPRINT "■■■■■■■■■■■■■■■■■■■■■
■■■■■■■■■■■"
 220 CLS
 230 RAND USR 16516
 240 COPY
 250 CLS
 260 PRINT "MORE? (Y/N)"
 270 IF INKEY$="Y" THEN GOTO 300
 280 IF INKEY$="N" THEN GOTO 330
 290 GOTO 270
 300 LPRINT "--------------------
------------"
 310 GOTO 220
 330 LPRINT
 335 LPRINT
 340 LPRINT
 350 STOP
9998 SAVE "CASSETTE LABE■"
9999 RUN
```

```
16514 118 118 205 42 10
16519 62 21 50 123 64
16524 42 37 64 229 205
16529 129 65 237 75 37
16534 64 225 197 167 237
16539 66 40 242 12 40
16544 239 205 137 65 13
16549 33 191 253 167 237
16554 66 42 14 64 32
16559 3 35 126 254 118
16564 40 96 24 248 203
16569 64 32 72 203 65
16574 40 68 203 73 32
16579 10 203 72 32 6
16584 195 146 65 0 0
16589 0 203 81 40 190
16594 203 89 32 4 203
16599 104 40 100 203 97
16604 32 16 203 104 40
16609 114 203 96 40 91
16614 203 88 40 81 203
16619 72 40 53 203 105
16624 32 4 203 104 32
16629 14 203 113 32 4
16634 203 104 32 6 203
16639 121 40 2 24 140
16644 229 205 189 7 126
16649 225 119 35 126 254
16654 118 40 5 34 14
16659 64 24 236 58 123
16664 64 61 254 255 40
16669 228 50 123 64 24
16674 232 43 126 254 118
16679 32 13 58 123 64
16684 60 254 22 40 209
16689 50 123 64 24 237
16694 62 0 119 24 47
16699 35 24 39 43 24
16704 36 58 123 64 60
16709 254 22 40 185 50
16714 123 64 1 33 0
16719 167 237 66 24 22
```

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```
16724 58 123 64 61 254
16729 255 40 166 50 123
16734 64 1 33 0 9
16739 24 5 126 254 118
16744 40 152 34 14 64
16749 205 129 65 33 52
16754 64 62 5 119 126
16759 61 32 252 237 75
16764 37 64 195 158 64
16769 42 14 64 126 198
16774 128 119 201 42 14
16779 64 126 254 64 248
16784 24 243 58 37 64
16789 60 32 250 193 201
```

Cloning

K Burkhill,
Deeside,
Clwyd.



THIS PROGRAM WILL make exact copies of any Spectrum program up to about 41K on a 48K machine, and about 8K on a 16K machine. It can copy unstoppable programs and programs which are headerless. It is simple to use and can, once the program to be copied is loaded, be used to make copies continuously.

The program listing should be typed in, then the instructions Goto 120 Enter etc. This program should now be Saved.

As most Spectrum programs load in two or three parts, each part must be copied separately with its header if it has one. The first part will definitely have a header so, after typing Run Enter, value a should be entered and the program to be copied loaded in from the start.

When any part has loaded, the instructions will again be printed and the tape should be stopped and removed from the recorder. The tape to be copied should now be put into the recorder, and the value c — if the part has a header — entered. The part will now Save with its header and the instructions again be printed when the tape should be stopped, giving the opportunity to either make further copies of that part to other tapes or to load the next part of the original program, and repeat the above.

If any part is headerless it will not Load or Save with values a or c entered; values b and d should be used. Value d will immediately start to Save and the recorder should be recording before this is entered. Value s will stop the procedure.

```
   1 REM 00000000000000000000000
000000000000000000000000000000000
000000000000000000000000000000000
   5 CLEAR 24450
  10 PRINT "enter "
  20 PRINT "a - load program wit
h header"
  30 PRINT "b - load program wit
hout header"
  40 PRINT "c - save program wit
h header"
  50 PRINT "d - save program wit
h out header"
  60 INPUT a$
  70 IF a$="a" THEN RANDOMIZE US
R 23782
  80 IF a$="b" THEN RANDOMIZE US
R 23795
  90 IF a$="c" THEN RANDOMIZE US
R 23821
 100 IF a$="d" THEN RANDOMIZE US
R 23831
 105 IF a$="s" THEN STOP
 110 GO TO 10
 120 RESTORE 140
 130 FOR f=23782 TO 23843
 135 READ q: POKE f,q
 140 DATA 55,62,0,221,33,210,92,
17,19,0,205,86,5,55,62,255,221,3
3,138,95,17,255,255,205,86,5,221
,229,225,17,138,95,175,237,82,34
,208,92,201
 145 DATA 33,139,95,221,33,210,9
2,195,112,9,62,255,221,33,139,95
,237,91,208,92,195,194,4
 150 NEXT f
 160 STOP
```

Programs can be made secure from this program and all similar ones available by, for instance, making them too big.

Graphics dump

David C Grindrod,
Crawley,
Oxfordshire.

THIS PROGRAM ENABLES mode 4 white on black graphics to be copied to an Epson printer in about 14 minutes. With a few modifications double-size printouts can also be obtained on the MX-100F/T3.

To understand the operation of the program you have to appreciate how the graphics display is configured on the Dragon, and how this is related to the Epson print-head. The graphics display is made up of 192 rows each containing 32 bytes, with the location address running from left to right and the MSB leftmost in the byte. The top left-hand corner of the display looks like that in figure 1.

Figure 1.

Mem. Addr.	1536	1537	1538	
1536	76543210	76543210	76543210	Bit No.
1568	76543210	765 . . .		
1600	76543210			

This assumes that page 1 is the first graphics page. Each bit represents a single pixel, hence a horizontal resolution of $8*32=256$. In the black and white mode if a bit is set — 1 — then the pixel is illuminated, if unset — 0 — then it is clear.

The Epson print-head requires data about columns rather than rows. The data is outputted to the printer, as a series of eight bit bytes, which represent the eight print wires of the head, the top wire corresponding to the MSB. Referring to figure 1 we see that the first byte sent to the printer will represent the state of bit 7 for the first eight rows, the new byte will be for bit 6 of the first eight rows and so on until the right-hand edge of the display is reached. At this point the whole process needs to be repeated for the next eight rows down.

Program 1. GDUMP.

```
40000 PRINT#-2,CHR$(27);"à";CHR$(27);"A";CHR$(8);CHR$(13);
40010 POKE65495,0
40020 FORA=1536TO7679 STEP256
40030 PRINT#-2,CHR$(27);"K";CHR$(0);CHR$(1);
40040 FORB=A TOA+31
40050 C=128
40060 FORY=0TO7
40070 F=128:E=0:D=B
40080 FORZ=0TO7
40090 IF (C AND PEEK(D)) >0 THEN E=E+F
40100 D=D+32:F=F/2:NEXTZ
40110 PRINT#-2,CHR$(E);
40120 C=C/2:NEXTY
40130 NEXTB:PRINT#-2,CHR$(10);
40140 NEXTA:POKE65494,0:RETURN
```

Program 2. BGDUMP.

```
40000 PRINT#-2,CHR$(27);"à";CHR$(27);"A";CHR$(8);CHR$(13);
40010 POKE65495,0
40020 FORA=1536TO7679 STEP128
40030 PRINT#-2,CHR$(27);"K";CHR$(0);CHR$(2);
40040 FORB=A TOA+31
40050 C=128
40060 FORY=0TO7
40070 F=128:E=0:D=B
40080 FORZ=0TO3
40090 IF (C AND PEEK(D)) >0 THEN E=E+F+(F/2)
40100 D=D+32:F=F/4:NEXTZ
40110 PRINT#-2,CHR$(E);CHR$(E);
40120 C=C/2:NEXTY
40130 NEXTB;PRINT#-2,CHR$(10);
40140 NEXTA:POKE65494,0:RETURN
```

By using high line numbers the program can be merged on to the end of any graphics program. This is achieved by CLoading your program and then typing

?PEEK(25),PEEK(26),PEEK(27),PEEK(28)

and noting the values. Then Poke the value in 27 to 25 and the value -2 in 28 to 26. If the value in 28 is 0 or 1 then the Poke value to 25 is reduced by one and the value to 26 becomes 255 — if 28=1 — or 254 — if 27=0.

Now CLoad the graphics dump program. Finally Poke the original values of locations 25 and 26 back. List should now show the two programs merged. The End statement in the original program should be replaced by

xxxx GOSUB 40000:END

where xxxx is the line number. On execution of Run the program will behave as normal, on completion of the plot the display is copied to the printer. Extra copies can be made by typing

RUN xxxx

On an MX-100, program 2 will give a double sized printout, this is merely program 1 with a few modifications. Basically the printer is made to plot in block graphics of two by two pixels. ■

(continued from page 201)

```
16724 58 123 64 61 254
16729 255 40 166 50 123
16734 64 1 33 0 9
16739 24 5 126 254 118
16744 40 152 34 14 64
16749 205 129 65 33 52
16754 64 62 5 119 126
16759 61 32 252 237 75
16764 37 64 195 158 64
16769 42 14 64 126 198
16774 128 119 201 42 14
16779 64 126 254 64 248
16784 24 243 58 37 64
16789 60 32 250 193 201
```

Cloning

K Burkhill,
Deeside,
Clwyd.



THIS PROGRAM WILL make exact copies of any Spectrum program up to about 41K on a 48K machine, and about 8K on a 16K machine. It can copy unstoppable programs and programs which are headerless. It is simple to use and can, once the program to be copied is loaded, be used to make copies continuously.

The program listing should be typed in, then the instructions Goto 120 Enter etc. This program should now be Saved.

As most Spectrum programs load in two or three parts, each part must be copied separately with its header if it has one. The first part will definitely have a header so, after typing Run Enter, value a should be entered and the program to be copied loaded in from the start.

When any part has loaded, the instructions will again be printed and the tape should be stopped and removed from the recorder. The tape to be copied should now be put into the recorder, and the value c — if the part has a header — entered. The part will now Save with its header and the instructions again be printed when the tape should be stopped, giving the opportunity to either make further copies of that part to other tapes or to load the next part of the original program, and repeat the above.

If any part is headerless it will not Load or Save with values a or c entered; values b and d should be used. Value d will immediately start to Save and the recorder should be recording before this is entered. Value s will stop the procedure.

```
   1 REM 00000000000000000000000
00000000000000000000000000000000
0000000000000000000000000000000
   5 CLEAR 24450
  10 PRINT "enter "
  20 PRINT "a - load program wit
h header"
  30 PRINT "b - load program wit
hout header"
  40 PRINT "c - save program wit
h header"
  50 PRINT "d - save program wit
h out header"
  60 INPUT a$
  70 IF a$="a" THEN RANDOMIZE US
R 23782
  80 IF a$="b" THEN RANDOMIZE US
R 23795
  90 IF a$="c" THEN RANDOMIZE US
R 23821
 100 IF a$="d" THEN RANDOMIZE US
R 23831
 105 IF a$="s" THEN STOP
 110 GO TO 10
 120 RESTORE 140
 130 FOR f=23782 TO 23843
 135 READ q: POKE f,q
 140 DATA 55,62,0,221,33,210,92,
17,19,0,205,86,5,55,62,255,221,3
3,138,95,17,255,255,205,86,5,221
,229,225,17,138,95,175,237,82,34
,208,92,201
 145 DATA 33,139,95,221,33,210,9
2,195,112,9,62,255,221,33,139,95
,237,91,208,92,195,194,4
 150 NEXT f
 160 STOP
```

Programs can be made secure from this program and all similar ones available by, for instance, making them too big.

Graphics dump

David C Grindrod,
Crawley,
Oxfordshire.

THIS PROGRAM ENABLES mode 4 white on black graphics to be copied to an Epson printer in about 14 minutes. With a few modifications double-size printouts can also be obtained on the MX-100F/T3.

To understand the operation of the program you have to appreciate how the graphics display is configured on the Dragon, and how this is related to the Epson print-head. The graphics display is made up of 192 rows each containing 32 bytes, with the location address running from left to right and the MSB leftmost in the byte. The top left-hand corner of the display looks like that in figure 1.

Figure 1.

Mem. Addr.	1536	1537	1538	
1536	76543210	76543210	76543210	Bit No.
1568	76543210	765 . . .		
1600	76543210			

This assumes that page 1 is the first graphics page. Each bit represents a single pixel, hence a horizontal resolution of 8*32=256. In the black and white mode if a bit is set — 1 — then the pixel is illuminated, if unset — 0 — then it is clear.

The Epson print-head requires data about columns rather than rows. The data is outputted to the printer, as a series of eight bit bytes, which represent the eight print wires of the head, the top wire corresponding to the MSB. Referring to figure 1 we see that the first byte sent to the printer will represent the state of bit 7 for the first eight rows, the new byte will be for bit 6 of the first eight rows and so on until the right-hand edge of the display is reached. At this point the whole process needs to be repeated for the next eight rows down.

Program 1. GDUMP.

```
40000 PRINT#-2,CHR$(27);"a";CHR$(27);"A";CHR$(8);CHR$(13);
40010 POKE65495,0
40020 FORA=1536TO7679 STEP256
40030 PRINT#-2,CHR$(27);"K";CHR$(0);CHR$(1);
40040 FORB=A TOA+31
40050 C=128
40060 FORY=0TO7
40070 F=128:E=0:D=B
40080 FORZ=0TO7
40090 IF (C AND PEEK(D)) >0 THEN E=E+F
40100 D=D+32:F=F/2:NEXTZ
40110 PRINT#-2,CHR$(E);
40120 C=C/2:NEXTY
40130 NEXTB:PRINT#-2,CHR$(10);
40140 NEXTA:POKE65494,0:RETURN
```

Program 2. BGDUMP.

```
40000 PRINT#-2,CHR$(27);"a";CHR$(27);"A";CHR$(8);CHR$(13);
40010 POKE65495,0
40020 FORA=1536TO7679 STEP128
40030 PRINT#-2,CHR$(27);"K";CHR$(0);CHR$(2);
40040 FORB=A TOA+31
40050 C=128
40060 FORY=0TO7
40070 F=128:E=0:D=B
40080 FORZ=0TO3
40090 IF (C AND PEEK(D)) >0 THEN E=E+F+(F/2)
40100 D=D+32:F=F/4:NEXTZ
40110 PRINT#-2,CHR$(E);CHR$(E);
40120 C=C/2:NEXTY
40130 NEXTB;PRINT#-2,CHR$(10);
40140 NEXTA:POKE65494,0:RETURN
```

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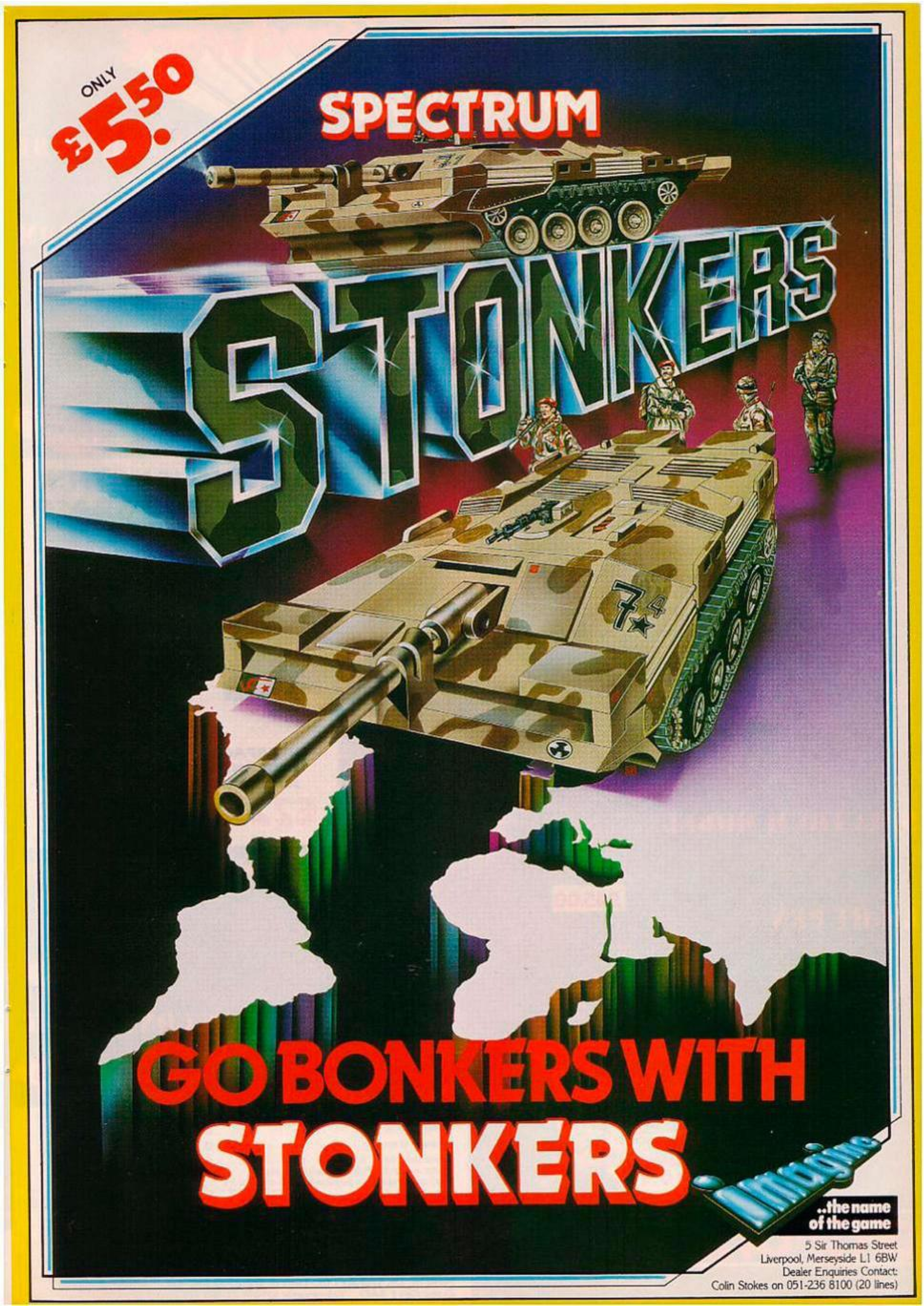
Now CLoad the graphics dump program. Finally Poke the original values of locations 25 and 26 back. List should now show the two programs merged. The End statement in the original program should be replaced by

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RUN xxxx

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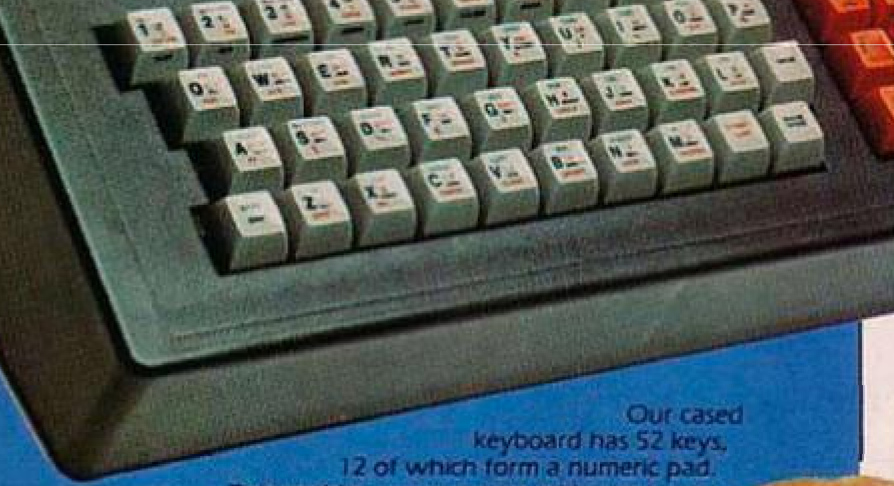


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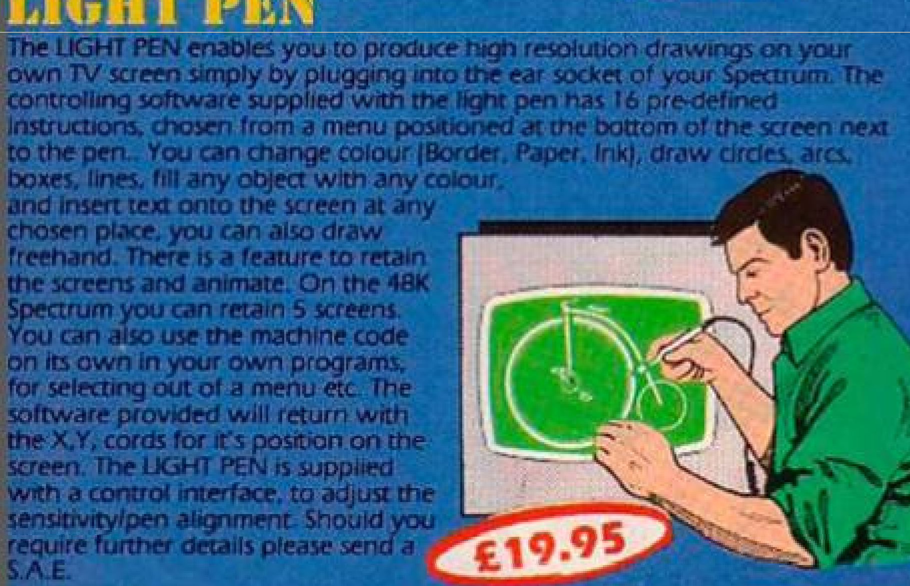
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COMPETITION CORNER

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.



COMPETITION RESULTS

In November we gave you the chance to get to grips with the latest and most prestigious add-on from Sinclair — the Microdrive. Entries ranged from rhymesters to wacky non-sequiturs, with a sturdy middle ground composed of those determined either to sing the praises of the new storage mechanism, or to make reference to those long-slumbering commands dedicated solely to its use. One entrant purred that "it would be purrfect for my purrposes". Surely this would have been more apposite to our Lynx competition?

The sentence to be completed was "The Microdrive would help my Spectrum really come alive because . . ."

Soul-brother Mr G N Ward brooks no prevariacation with his "Don't give me no jive, tell Sir Clive, I need the drive." Jive was a recurring theme, as was staying alive, as exemplified by Mr S Randles' "in order to naturally grow and survive, we rely on Sir Clive." Luckily not all of us are so dependent on Sinclair Research as this competitor and his Spectrum.

Speed is one of the basic features of the Microdrive — hence M A Griffiths' "I'd be nailing bytes in moments instead of biting nails for minutes." Perhaps psychologists who opine that rapid-eye movement or REM sleep should look at the insomnia curing possibilities of waiting for a cassette to load; Mr Keith Larter thought that the Microdrive's "higher baud rate means less bored rate; user prone to REM sleep." Speed and rhyme were combined by Mr Peter Howells in "Load time will dive, from 50 seconds to five; thanks, Sir Clive" Simon Wheeler felt sure that it would "bus my ideas in at top speed?".

Mae West was invoked by P N Millen: "It ain't the stringy-floppy in your life that matters . . .", and doubtless would have approved of K W Holmes' opinion that his Spectrum would come alive "because of the excitement of getting fresh was fast bauds."

On a festive note, Mr J Ratcliffe was "dreaming of a byte Christmas."

Microdrive catch-phrases included "the extra gear will get my stream machine into overdrive" — from T Bratley.

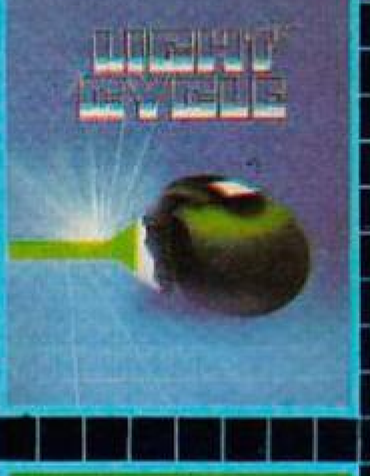
Choosing from among so many entries was a thorny problem indeed, but we finally plumped for Michael Bryan's, Astley, Leicester echo of the heady days of early spaceflight with his variation on Neil Armstrong's words: "It's one small drive for computers, but one giant leap for users."

HOPPER

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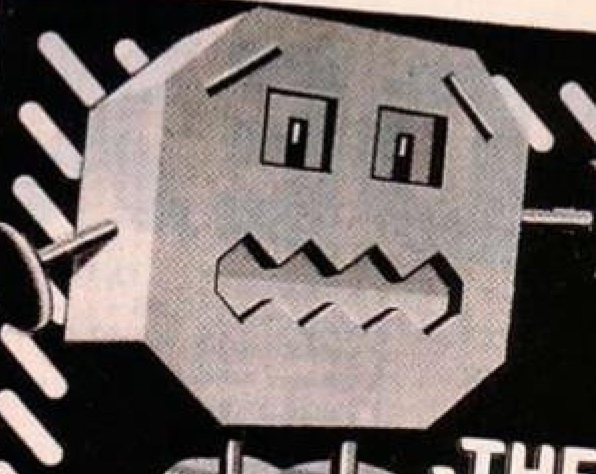
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YOUR COMPUTER INDEX

Numbers represent volume, issue, page.

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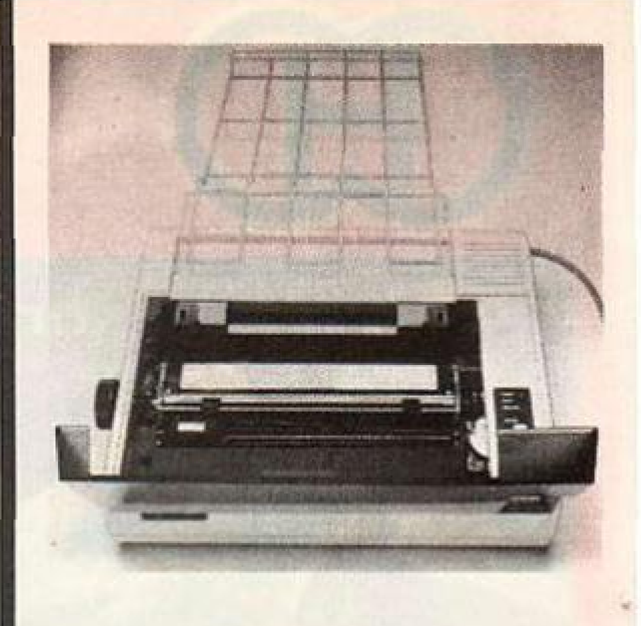
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(continued on page 215)



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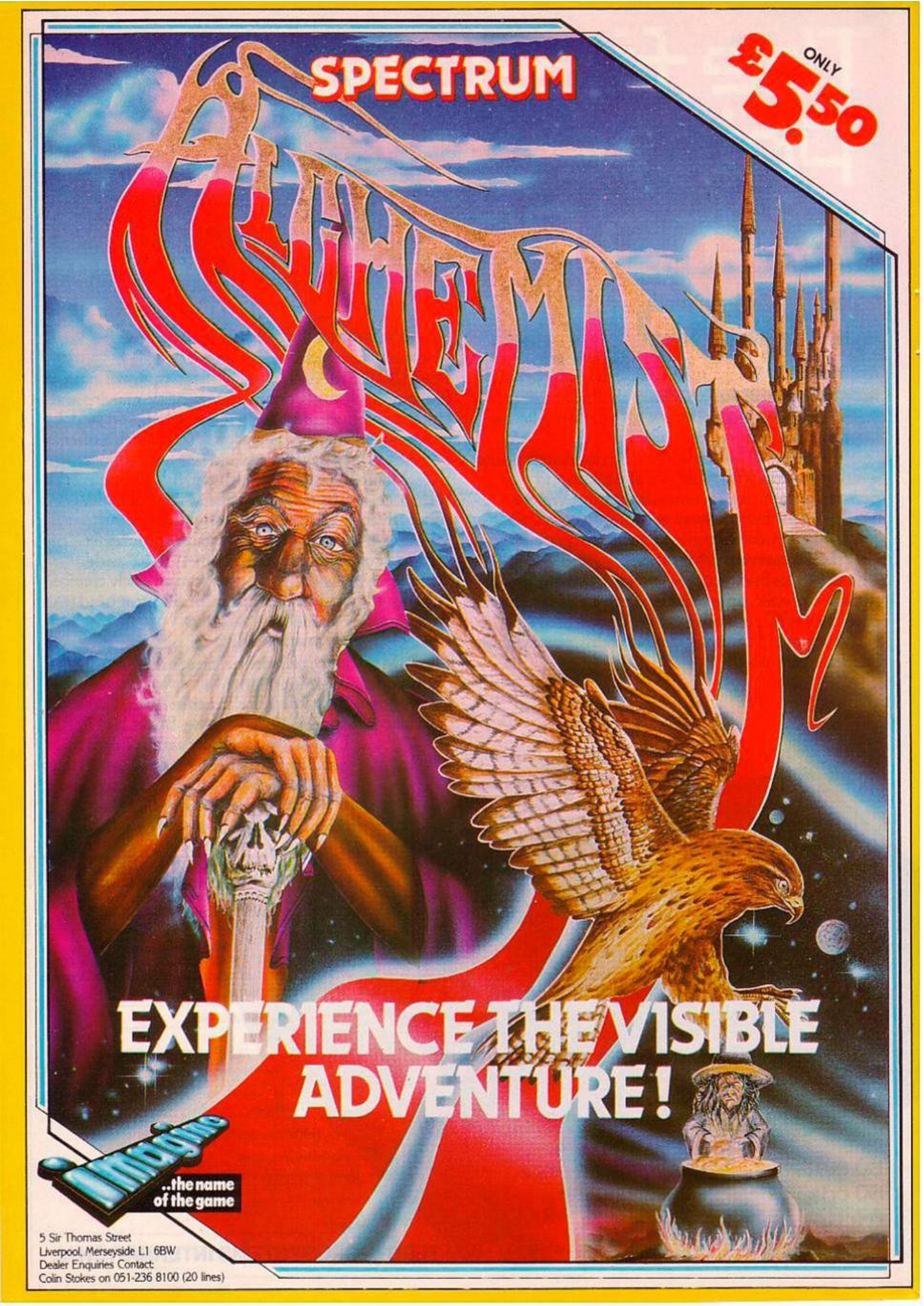
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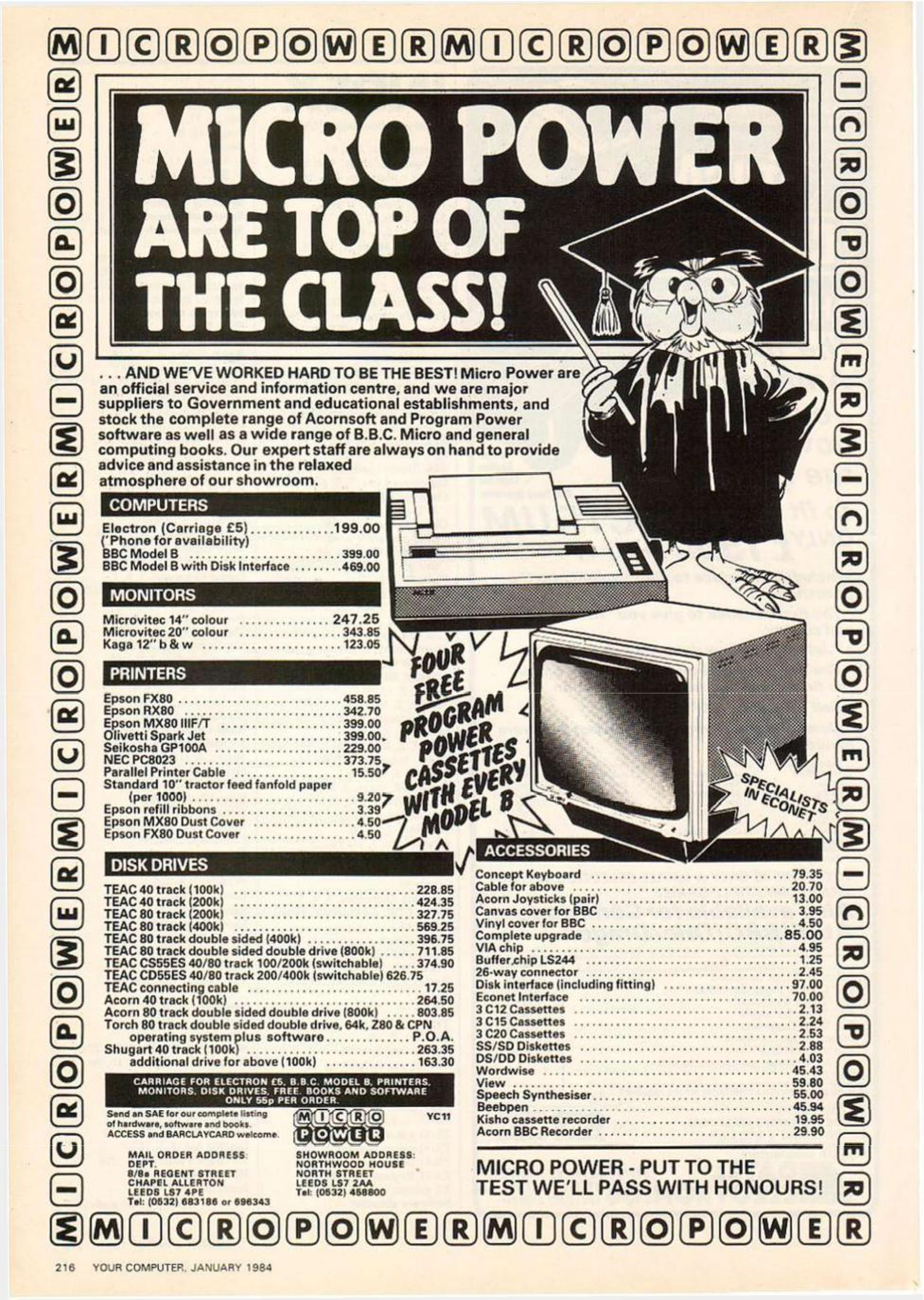

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Epson RX80 .... 342.70
Epson MX80 IIIF/T 399.00
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NEC PC8023 .... 373.75
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FOUR FREE PROGRAM POWER CASSETTES WITH EVERY MODEL B
SPECIALISTS IN ECONET
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additional drive for above (100k) 163.30
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YC11
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Vinyl cover for BBC 4.50
Complete upgrade 85.00
VIA chip 4.95
Buffer chip LS244 .... 1.25
26-way connector 2.45
Disk interface (including fitting) 97.00
Econet Interface 70.00
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3 C15 Cassettes 2.24
3 C20 Cassettes 2.53
SS/SD Diskettes 2.88
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Speech Synthesiser 55.00
Beebpen 45.94
Kisho cassette recorder 19.95
Acorn BBC Recorder 29.90
MICRO POWER - PUT TO THE TEST WE'LL PASS WITH HONOURS!

INDEX

(continued from page 215)

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NEWS
from SPECTRUM

DISK DRIVE for ZX SPECTRUM

Now from SPECTRUM a Disk Drive for the ZX SPECTRUM exclusive to SPECTRUM stores see our ad for full details

Super new add-on for ZX SPECTRUM

• New! SINCLAIR INTERFACE 2 and ROM CARTRIDGES plus new software -see our ad for details.

• Quality printer at under £200

SEIKOSHA GP-100A now only £199.95 from Spectrum.

LATEST NEWS

• For up-to-date news, information & offers from SPECTRUM - see PRESTEL page 600181 for full details.

Spectrum GIFT VOUCHERS

• Not sure what to buy? Why not give a SPECTRUM GIFT VOUCHER - available in any value over £5. See your local SPECTRUM dealer NOW!

NEW SPECTRUM MEMBERS

Check our address page! - there are many new SPECTRUM dealers throughout the UK so there's a good chance there'll be a SPECTRUM centre near you.

AFTER SALES CARE

SPECTRUM service centres will ensure that should your machine 'go down' we will get it running again as quickly as possible. We also offer extended warranties at reasonable prices too! - ask your SPECTRUM HOME COMPUTER CENTRE for full details

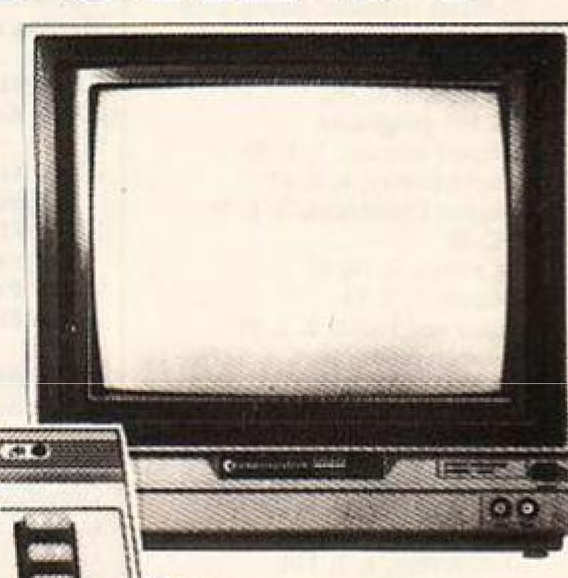
COMPUTER DEALERS

(or prospective Computer dealers!) If, you would like to know more about becoming a SPECTRUM APPOINTED DEALER on an exclusive area basis, please write to MIKE STERN, Spectrum (UK) Ltd., Burrowfield, Welwyn Garden City, Herts. or telephone (07073) 34761

Fantastic Value from Spectrum!

COMMODORE 64 BUSINESS PACKAGE

SAVE OVER £200



Includes:

- COMMODORE 64
- DISK DRIVE
- COLOUR MONITOR
- COMMODORE PRINTER
- FUTURE FINANCE PROGRAM

Plus!

- FREE! GAMES DISK WITH SIX GAMES

FOR THE SMALL BUSINESSMAN . . . this has to be the business computer opportunity of a lifetime! This superb, top-value package includes everything you need to set up your own powerful small business/home Micro system.

There's the high-power Commodore 64 computer with its huge 64K RAM memory built-in and brilliant graphics capability, with full colour. The system's completed with a Commodore disk drive – store your entire filing system, accounts, sales records, etc. – plus tractor-feed printer, and a 1701 colour monitor.

It really is tremendous package – at SPECTRUM'S incredible low price, it's unbeatable!



ALL THIS FOR ONLY £899.99 OR LESS!

All items can be purchased seperately - ask your local SPECTRUM dealer for price.

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ONLY £239.99

(Normal retail price £282.85)

SAVE OVER £40

Includes: ■ COMMODORE 64 ■ CASSETTE INTERFACE ■ CASSETTE RECORDER ■ VITA JOYSTICKS ■ CASSETTE WITH 4 GAMES

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

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SOFTWARE

The Top sellers from leading British Software houses.

Micro Dealer UK

ZX SPECTRUM

Legend "Valhalla"	£14.95
Ultimate "Lunar Jet Man"	£5.50
Ultimate "Atic Atac"	£5.50
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Incentive "Splatt"	£5.50
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Quicksilva "Bugaboo"	£6.95
Ultimate "Jet Pac"	£5.50
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Protek "Hunter Killer"	£7.95
Red Shift "Apocalypse"	£9.95
Ocean "Transversion"	£5.50
Ultimate "Tranz Am"	£5.50
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Artic "3-D Combat Zone"	£5.95
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Llamasoft "Attack of the Mutant Camels"	£7.50
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Quicksilva "Skyhawk"	£7.95
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UK Software "Zorgon's Revenge"	£8.50
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Softek "Ugh!"	£8.95
J Maurice Micros "Maurice Minor"	£7.95

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Cruising (ZX Spectrum)	£4.95
Blind Alley (ZX Spectrum)	£4.95
Androids (ZX Spectrum)	£5.95
Galaxy Attack (ZX Spectrum 48K)	£5.95
Sword Fight (ZX Spectrum)	£5.95

MICRODEAL

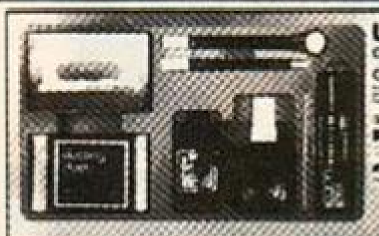
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Defence	£8.00
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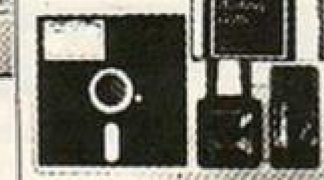
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GRANADA PERSONAL COMPUTING TITLES

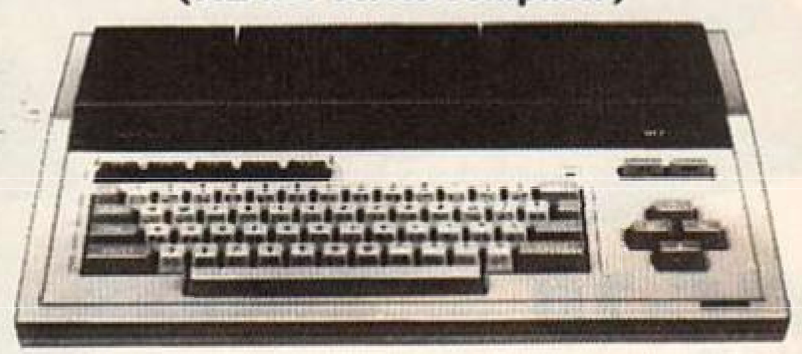
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The Spectrum Programmer	£5.95
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The Working Commodore 64	£5.95
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Galaxy Attack for 48K Spectrum	£5.95
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(MZ-700 Series Computer)



FREE! 10 CASSETTE BASED GAMES

The super new colour computer from SHARP. Now available in limited quantities - including 10 FREE CASSETTE BASED GAMES from SPECTRUM

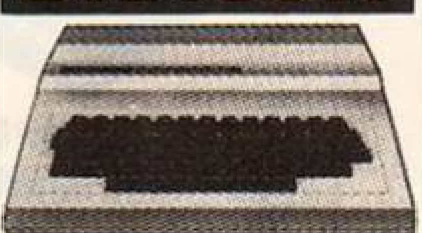
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DRAGON



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Buy the **Dragon 32** from SPECTRUM at £175 and pick up super ACCESSORY PACK **worth £50** including ■ COMPUTER CASSETTE RECORDER ■ JOYSTICKS ■ DRAGON CASSETTE TAPE

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LYNX 48K Model - SPECTRUM PRICE £199

Not all stores carry every advertised item, please phone before making a journey -prices correct at tme of going to press E&OE.

Everything you've ever wanted for your

ZX SPECTRUM

Superb ZX add-on's from your local Spectrum dealer

New & exclusive to Spectrum!

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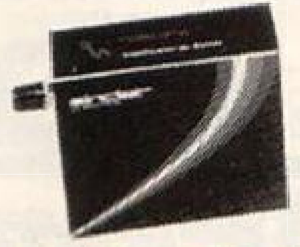
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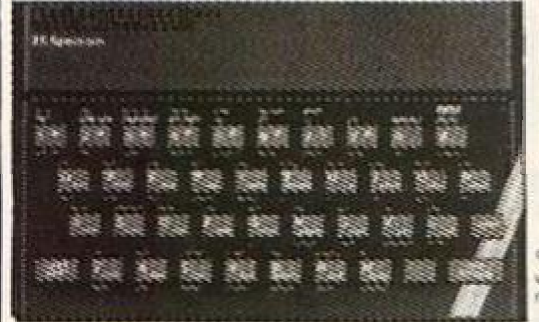
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From RD Labs for the ZX Spectrum

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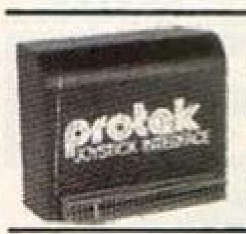
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Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd

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ONLY £245



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Joystick Interface
£14.95

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Joystick Interface
(Joysticks opt. extra)



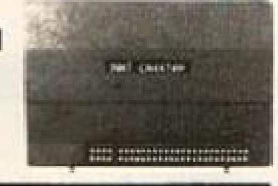
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Now, your ZX SPECTRUM is your key to the world with the incredible PRISM VTX 5000 MODEM
■ Versatile modem for ZX Spectrum (16K or 48K) versions ■ Slim design fits easily, matches your micro ■ Instant access to Prestel® & Micronet 800 information services ■ Instant communication with other ZX Spectrum users ■ Use the Prism VTX 5000 with a Sinclair printer - and print Prestel frames. Ask your local SPECTRUM dealer for further details - NOW!

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£99.95

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The new ROM Cartridge/Joystick interface. Loads programs instantly! Takes two joysticks! Just plug in and play.
ONLY £19.95
Plus! New ROM cartridge software.

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New! 600XL



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SPECTRUM PRICE

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ATARI 800

Check with your local SPECTRUM dealer for our SUPER LOW price.

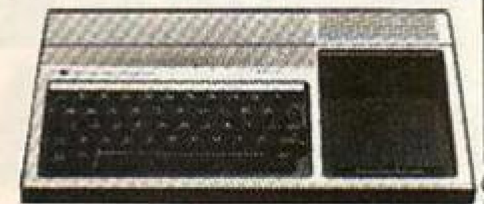




ATARI VCS GAMES MACHINE

With all these FREE extras: FREE PADDLES ■ FREE JOYSTICKS ■ FREE COMBAT CARTRIDGE ■ FREE PAC-MAN CARTRIDGE ALL FOR ONLY **£69.99**

TEXAS



TI-99/4A

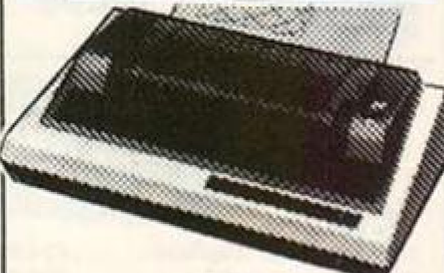
Exceptional value from SPECTRUM and representing probably the finest home micro computer value on the market today! - The TEXAS TI-99/4A is built to an extremely high standard and is highly recommended by SPECTRUM for its utter reliability.

SENSATIONAL NEW LOW PRICE

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£199.95

SEIKOSHA GP100 VC	£199.95
SEIKOSHA GP100 AS	£199.95
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EPSOM FX 80	£459.95
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MICROLINE 80	£249.95
MICROLINE 82A	£349.95
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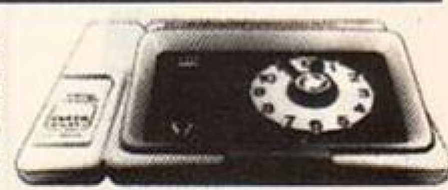
Here's the super Memotech MTX500 Micro - specially designed for versatility in a wide variety of applications. Its 16K ROM contains several languages & routines to suit users with differing levels of computer skills. Its RAM is a powerful 32K - expandable to a massive 512K - with full 16-colour high-definition graphic capability, and a superb top-quality keyboard. It's a superb Micro and you can see it at SPECTRUM now!

SUPERB VALUE AT ONLY

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SPECTRUM PRICE **£59.95**



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'The intelligent CHESS COMPUTER'

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Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

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READING David Saunders, 8 Yield Hall Place. TEL: (0734) 580719
WINDSOR Wycombe Video, 44 King Edward Court. TEL: (07535) 67441

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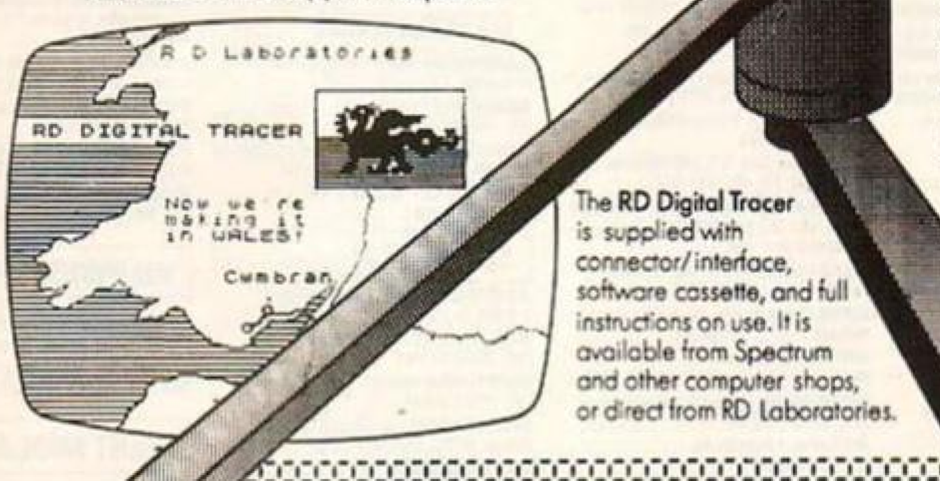
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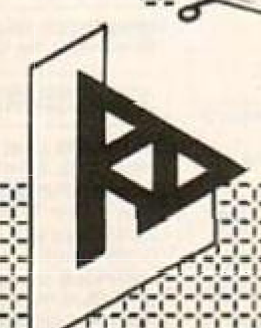
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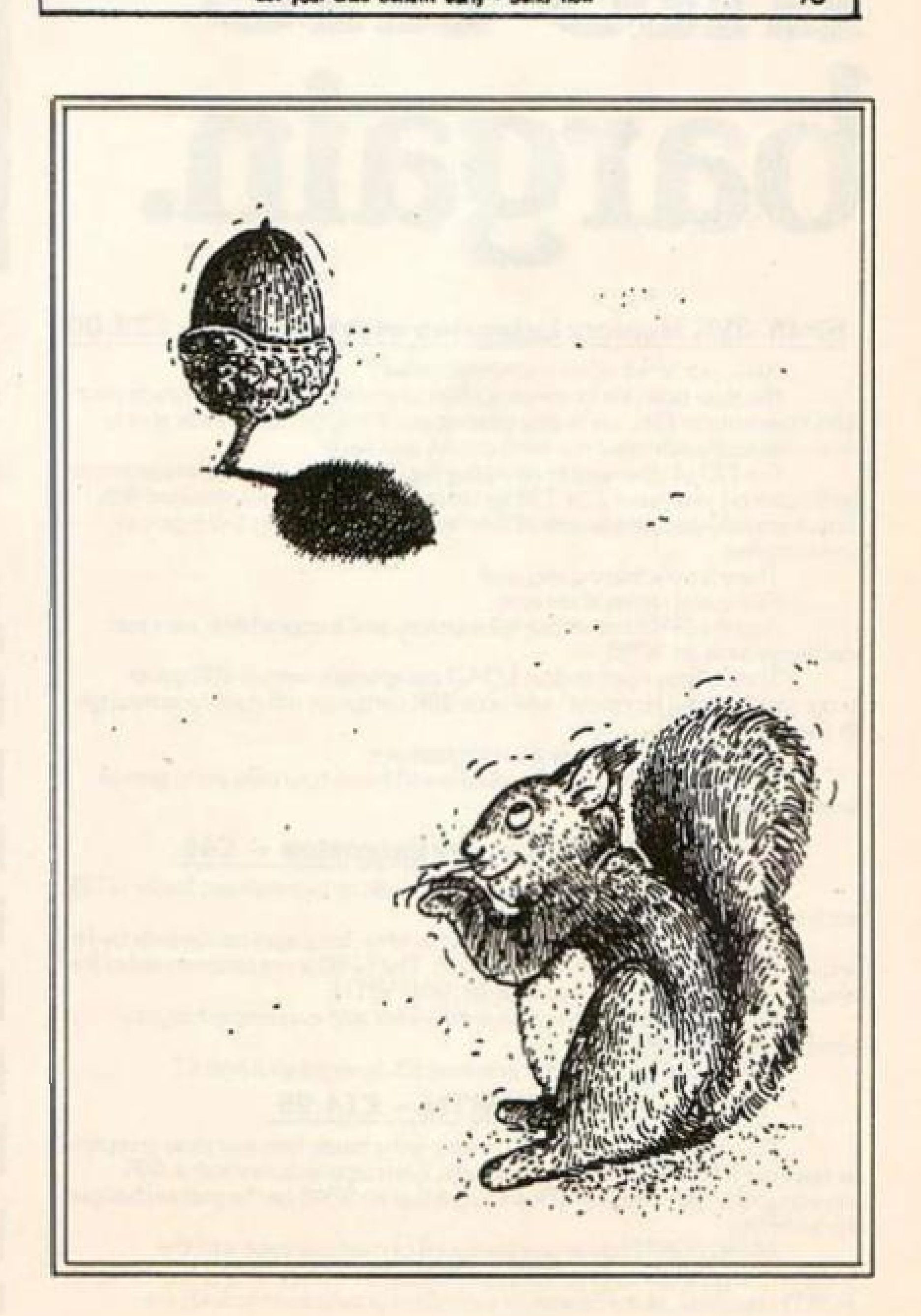
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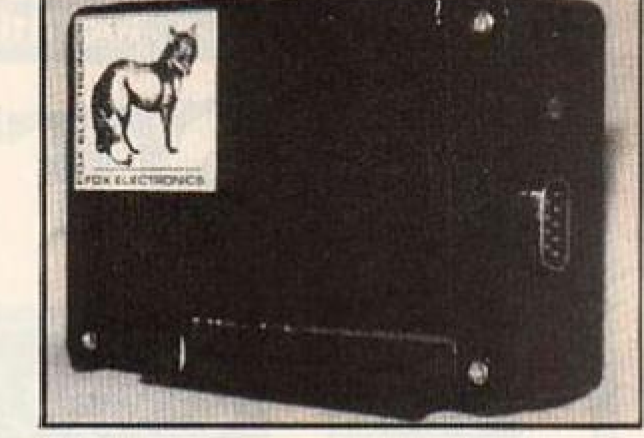
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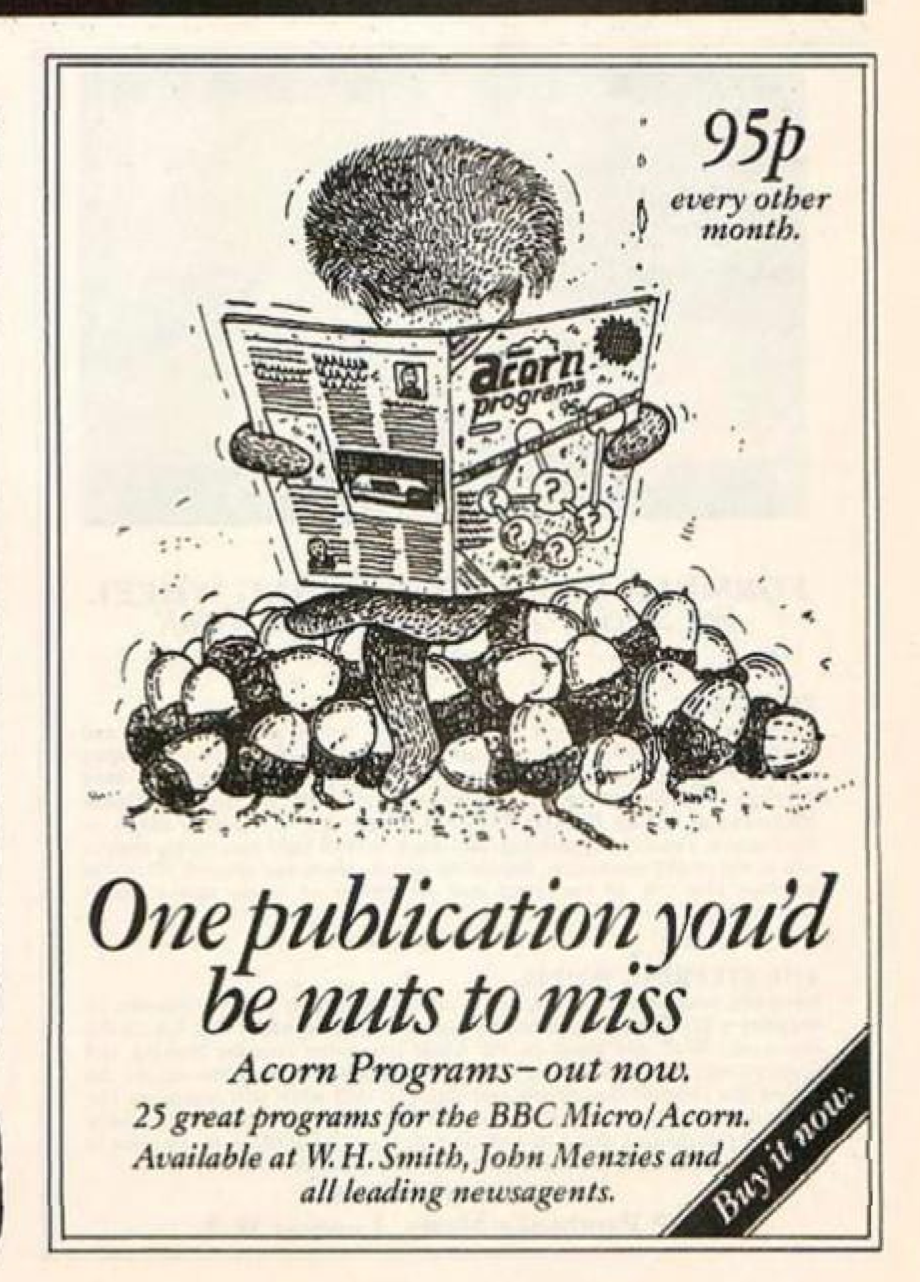
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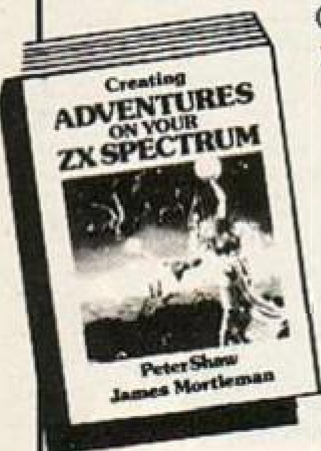
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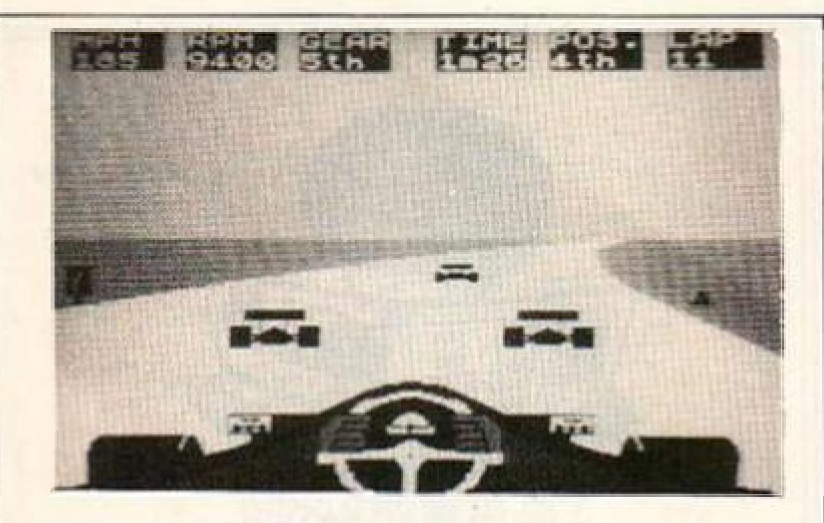
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For Sinclair ZX Spectrum 16K & 48K

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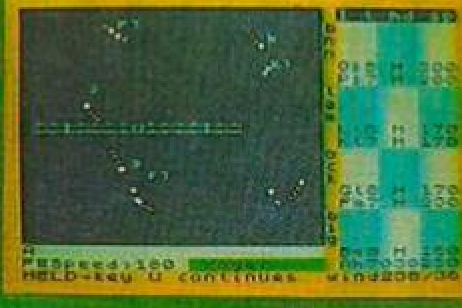
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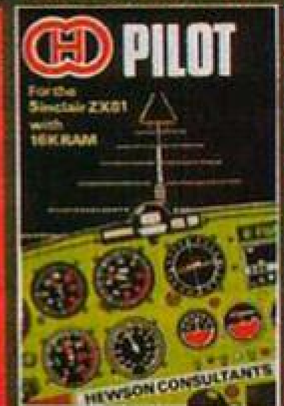
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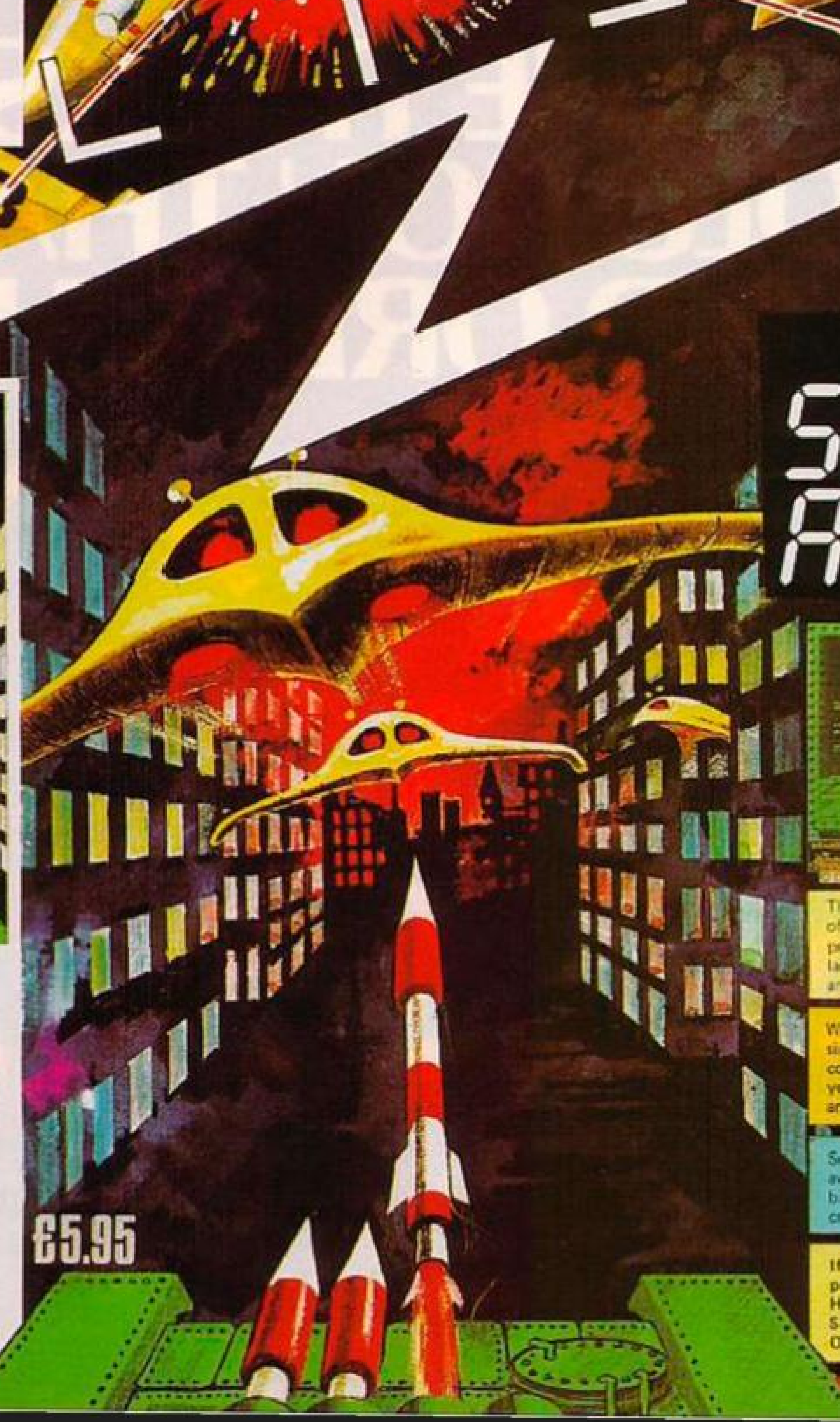
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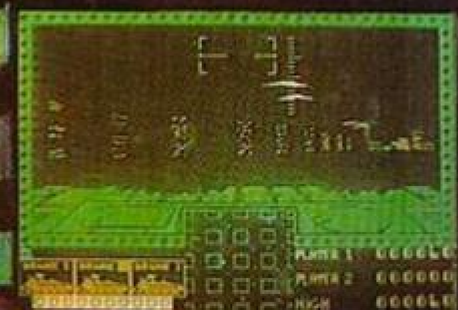
The Seiddab have broken through the Earth's defenses and are attacking the cities. You are patrolling the city streets in the latest Knat Tank with its surface to air missiles.

Trundling along you observe the tell tale blips of the Seiddab as they appear on your scanner. They break formation and scatter across the city. Suddenly you catch sight of an alien craft swooping over the buildings to your right. He fires a plasma torpedo at your tank. You attempt to dodge but the missile finds its mark, shaking your tank and leaving a hole in the armour.

You unleash a missile and guide it accurately to the target. The Seiddab explodes and crashes from sight. You hunch over the controls once more, because this is only the beginning . . .



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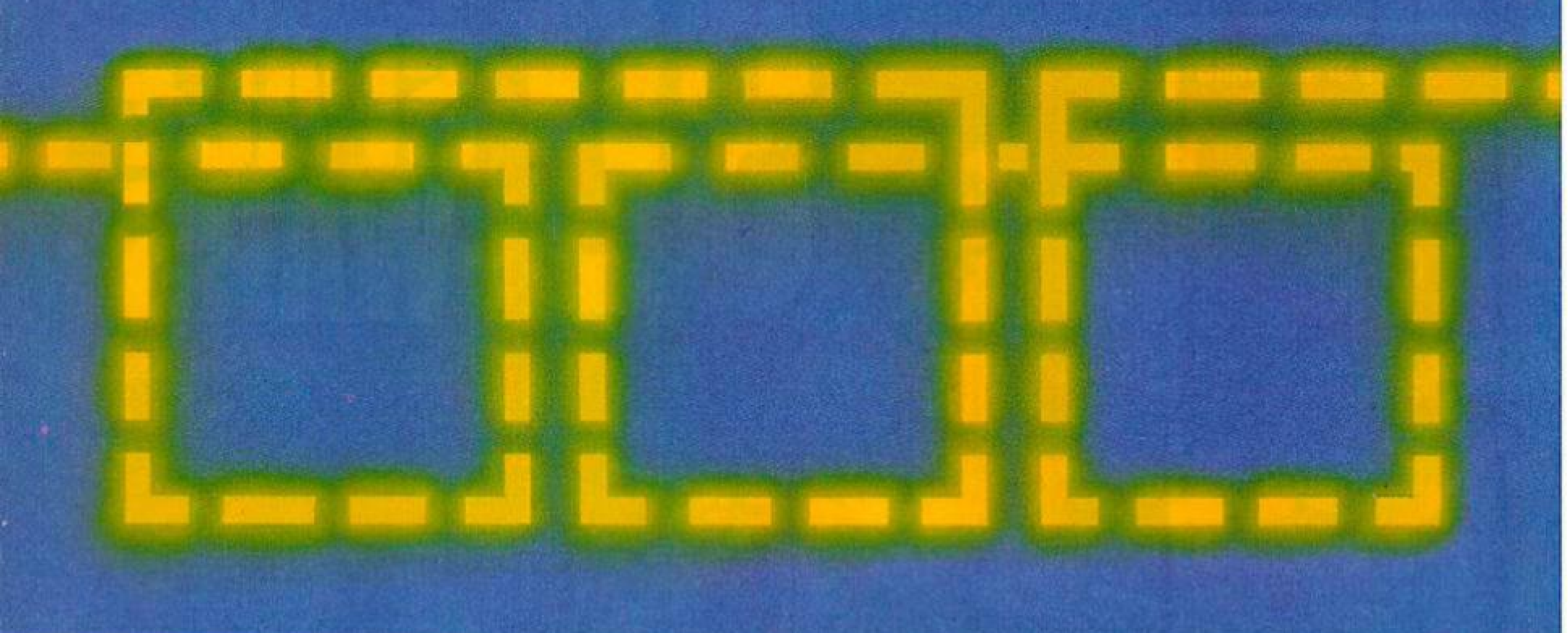


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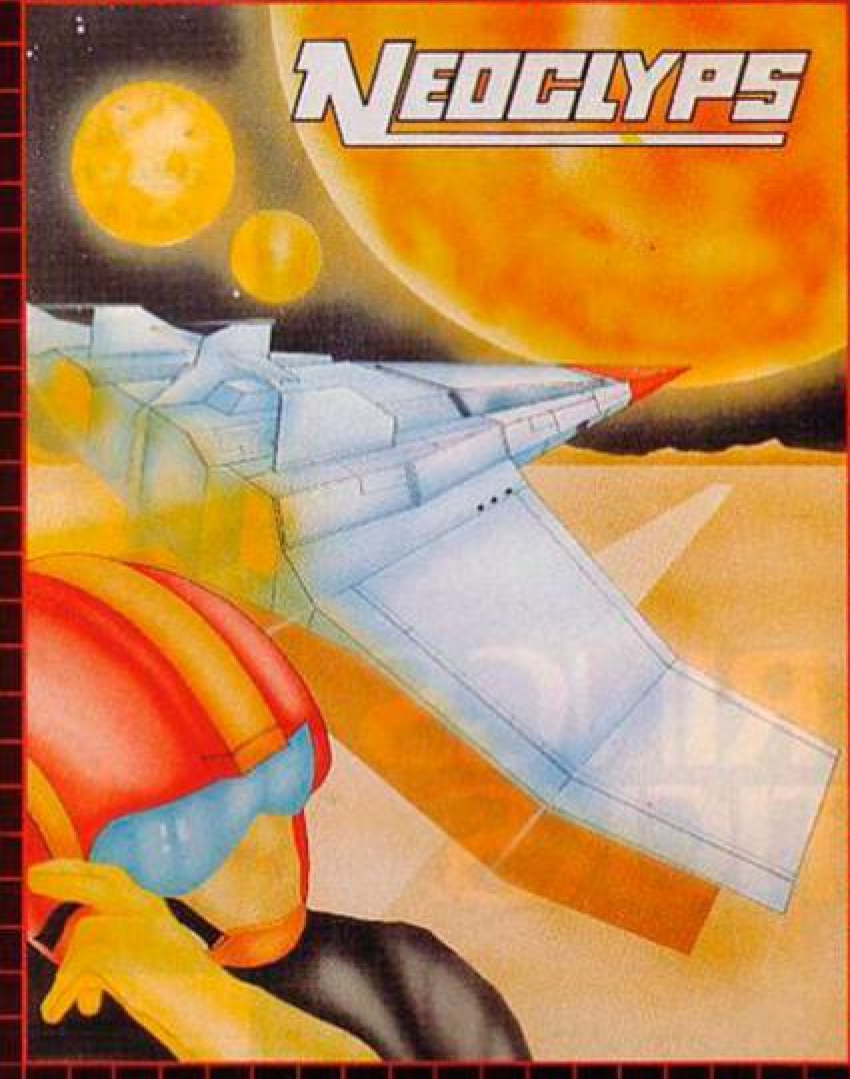
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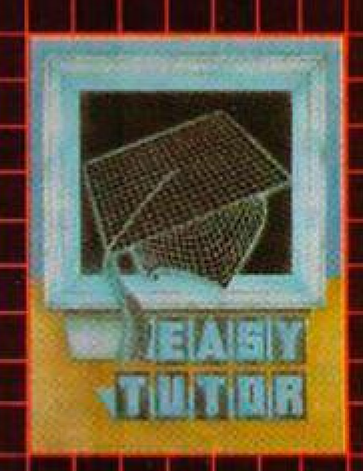

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And this makes Trickstick the only games system which does not wear out with heavy use!
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USE THE COUPON OR THE PHONE: Trickstick and Attaktics are in stock and available now. Trickstick including interface is £28. Attaktics is £7.50 if ordered with a Trickstick and £10 on its own. The Programmable Adaptor is £10 for Trickstick owners and £15 for others. The Training Tape is Free with each Trickstick..Or call us for the name of your local stockist.
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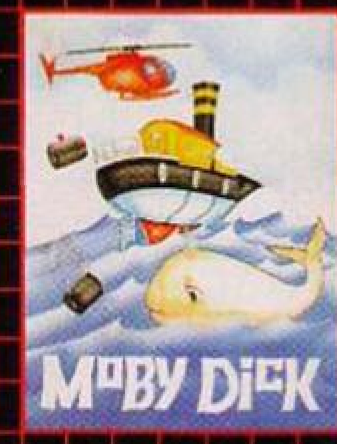
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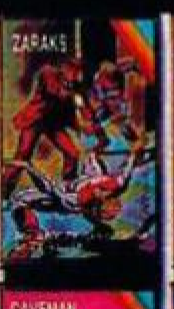
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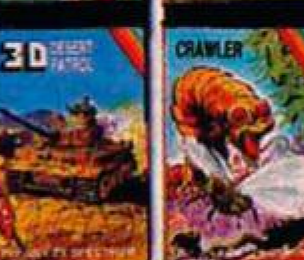
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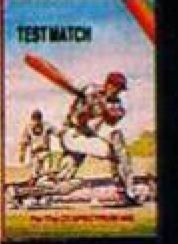


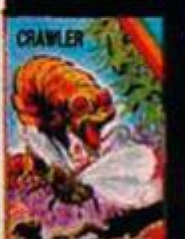


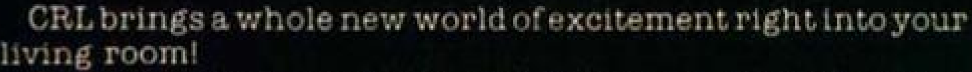












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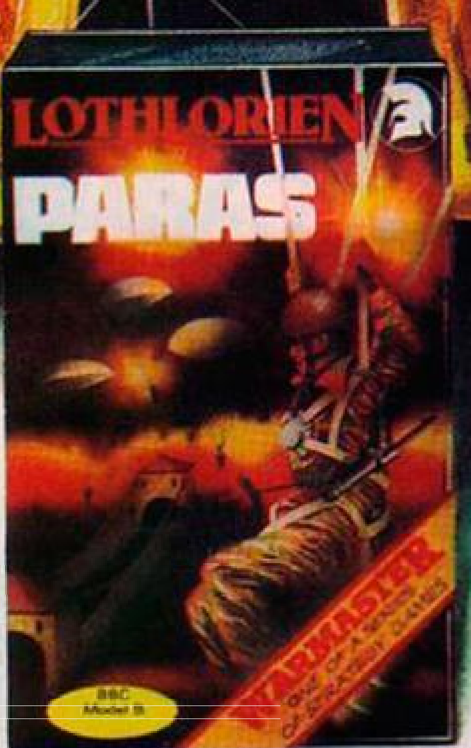
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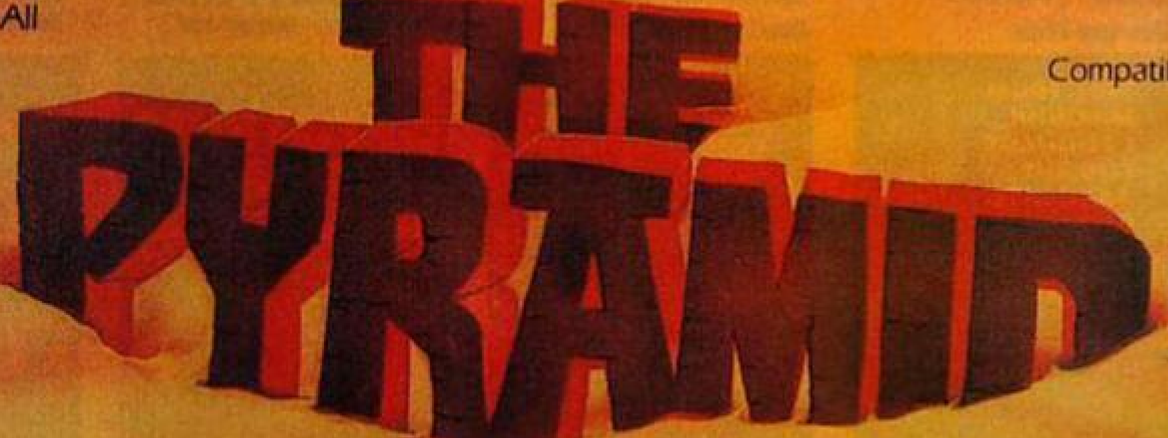
You proceed to explore the Pyramid from top to bottom with the difficulty generally increasing with the depth of level. Depending on the choice of exit from each chamber you are likely to have a different game every time you play.

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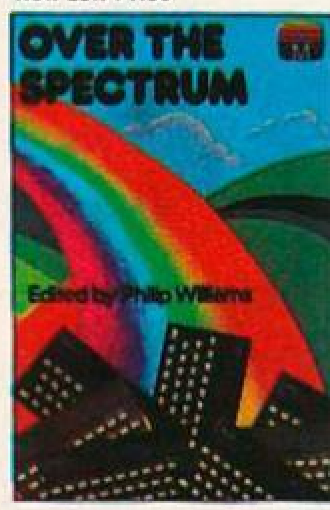
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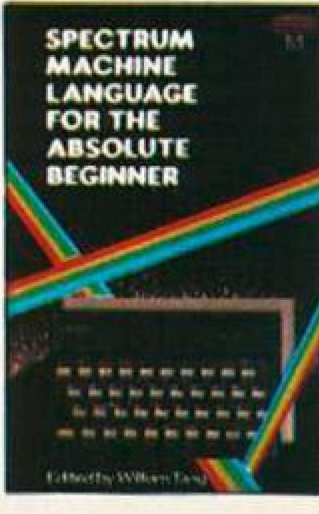
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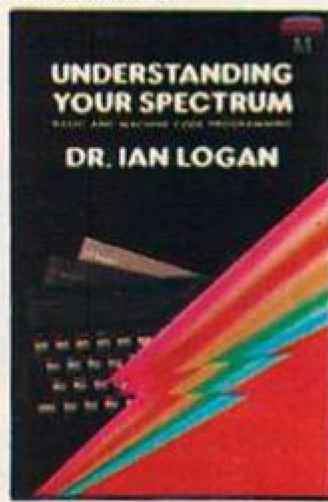
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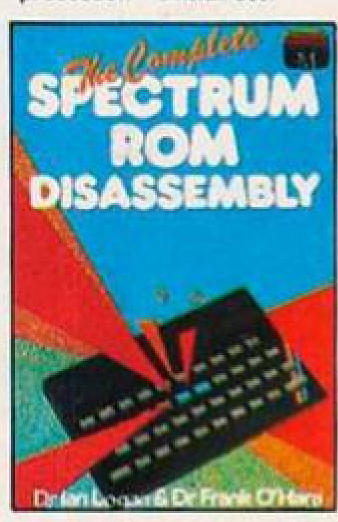
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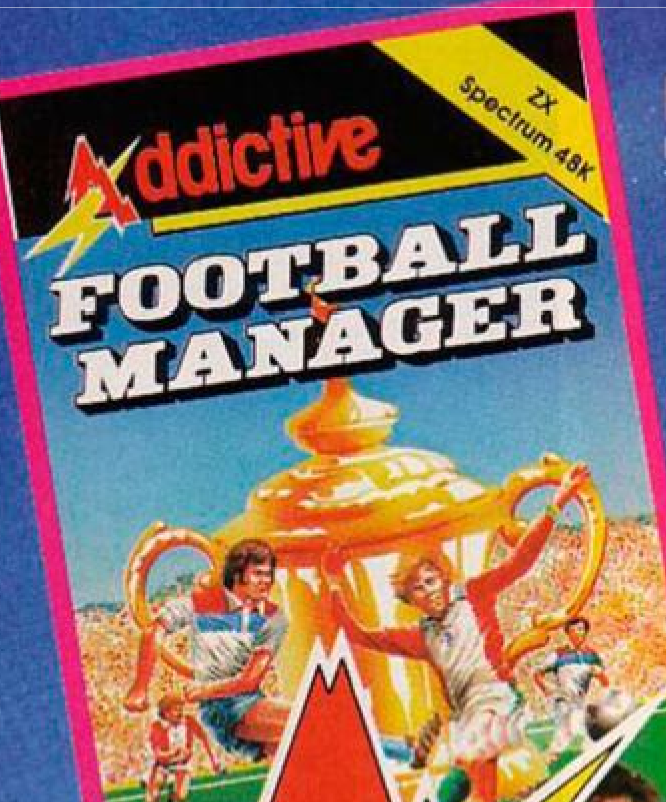
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*ZX81 Chart, Home Computing Weekly 16.8.83

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"Adventures which have a fast response time, are spectacular in the amount of detail and number of locations, and are available to cassette owners ... I am extremely impressed... The Level 9 Adventures are superbly designed and programmed, the contents first rate. The implementation of Colossal Cave (Adventure) is nothing short of brilliant; rush out and buy it. While you're at it, buy their others too. Simply smashing!"
- SOFT, Sept 83

"I found Dungeon exceedingly well planned and written, with a fast response. There are well over 200 locations and the descriptions are both lengthy and interesting. The objects number about 100. It could therefore take some months to explore the whole network, giving many hours of enjoyment in the process."
- C&VG, Sept 83

"The descriptions are so good that few players could fail to be ensnared by the realism of the mythical worlds where they are the hero or heroine ... great fun to play."
-Which Micro?, Aug 83

"My appetite has been whetted and I intend to get my own copy (of Snowball) to play."
- What Micro?, Dec 83



ADVENTURE REVIEWS

"This has to be the bargain of the year. If adventures are your game then this (Colossal Adventure) is your adventure."
- HCW, 5 Sept 83

"Colossal Adventure is simply superb. Anyone who wishes to use adventures in an educational setting really must use and see this program as it emulates Crowther and Wood's masterpiece so well. For those who wish to move onto another adventure of similar high quality, Dungeon Adventure is to be recommended. With more than 200 locations, 700 messages and 100 objects it will tease and delight!"
- Educational Computing, Nov 83

Colossal Adventure is included in Practical Computing's Top 10 games choice: "Poetic, moving and tough as hell."
- PC, Dec 83

"To sum up, Adventure Quest is a wonderful program, fast, exciting and challenging. If you like adventures then this one is for you"
- NILUG # 1.3

"Colossal Adventure ... For once here's a program that lives up to its name ... a masterful feat. Thoroughly recommended"
- Computer Choice, Dec 83

"wholly admirable"
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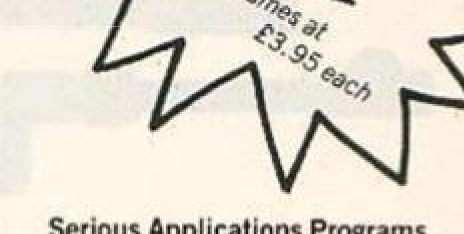
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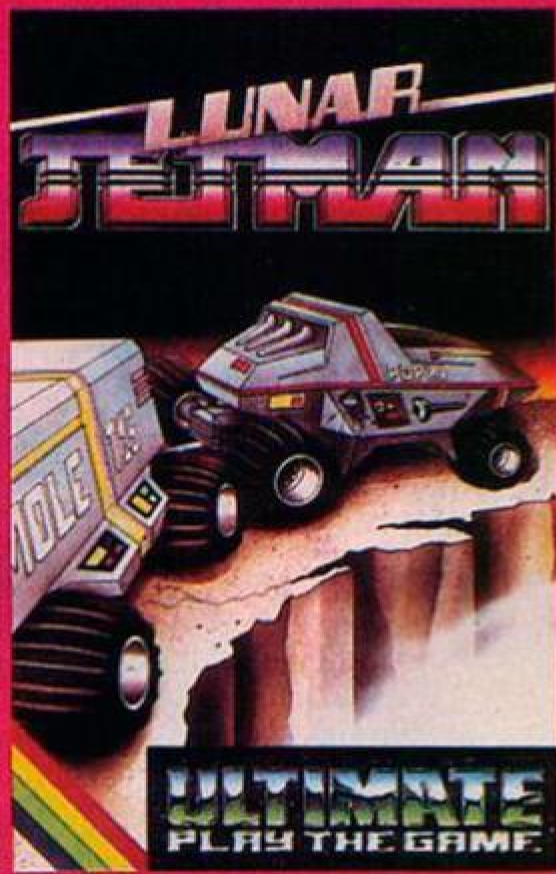
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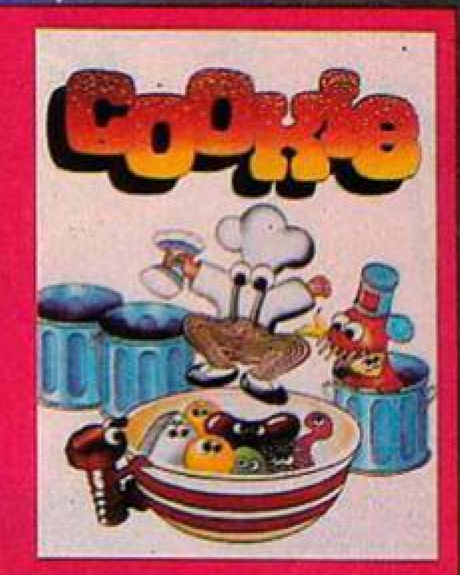
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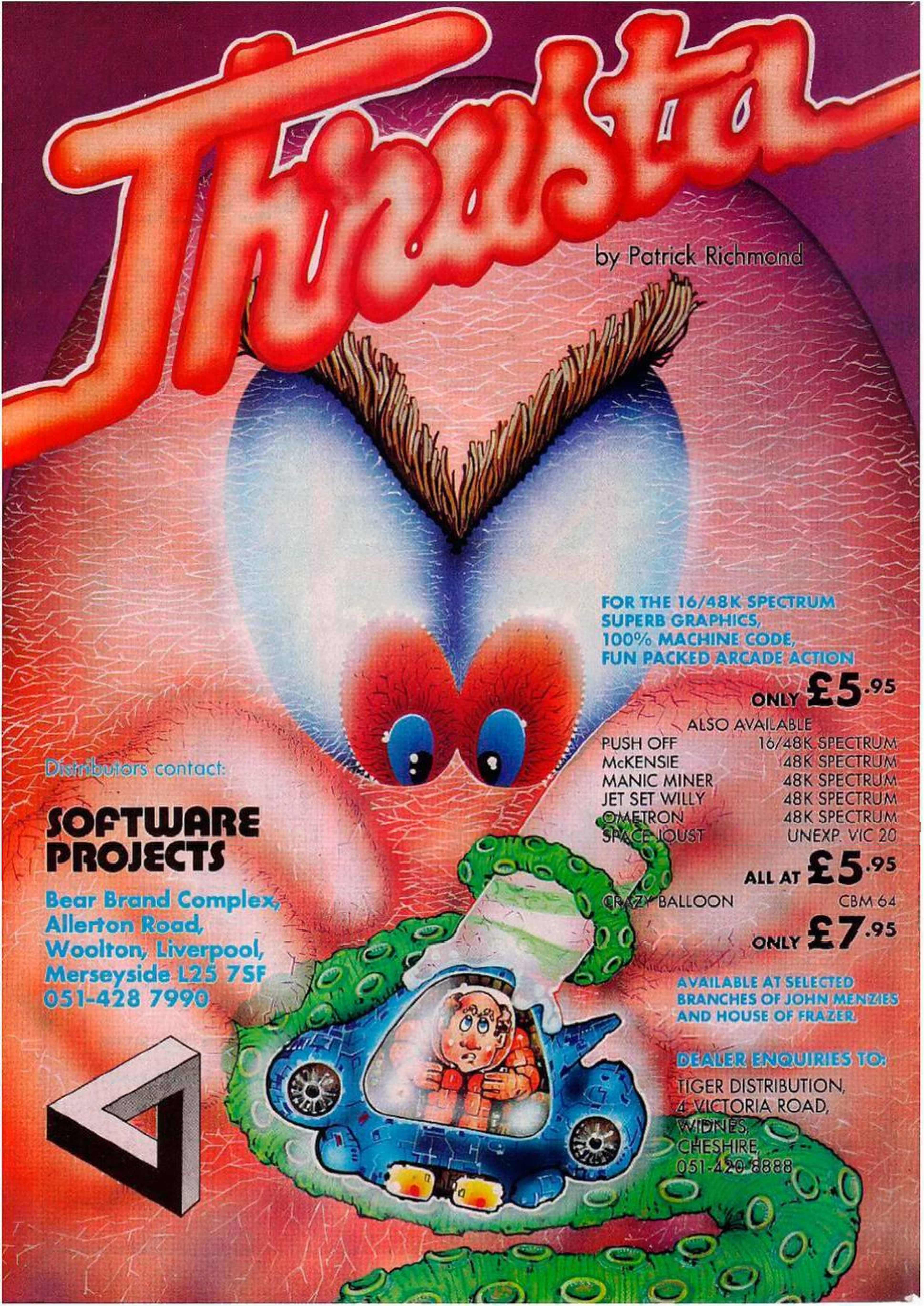
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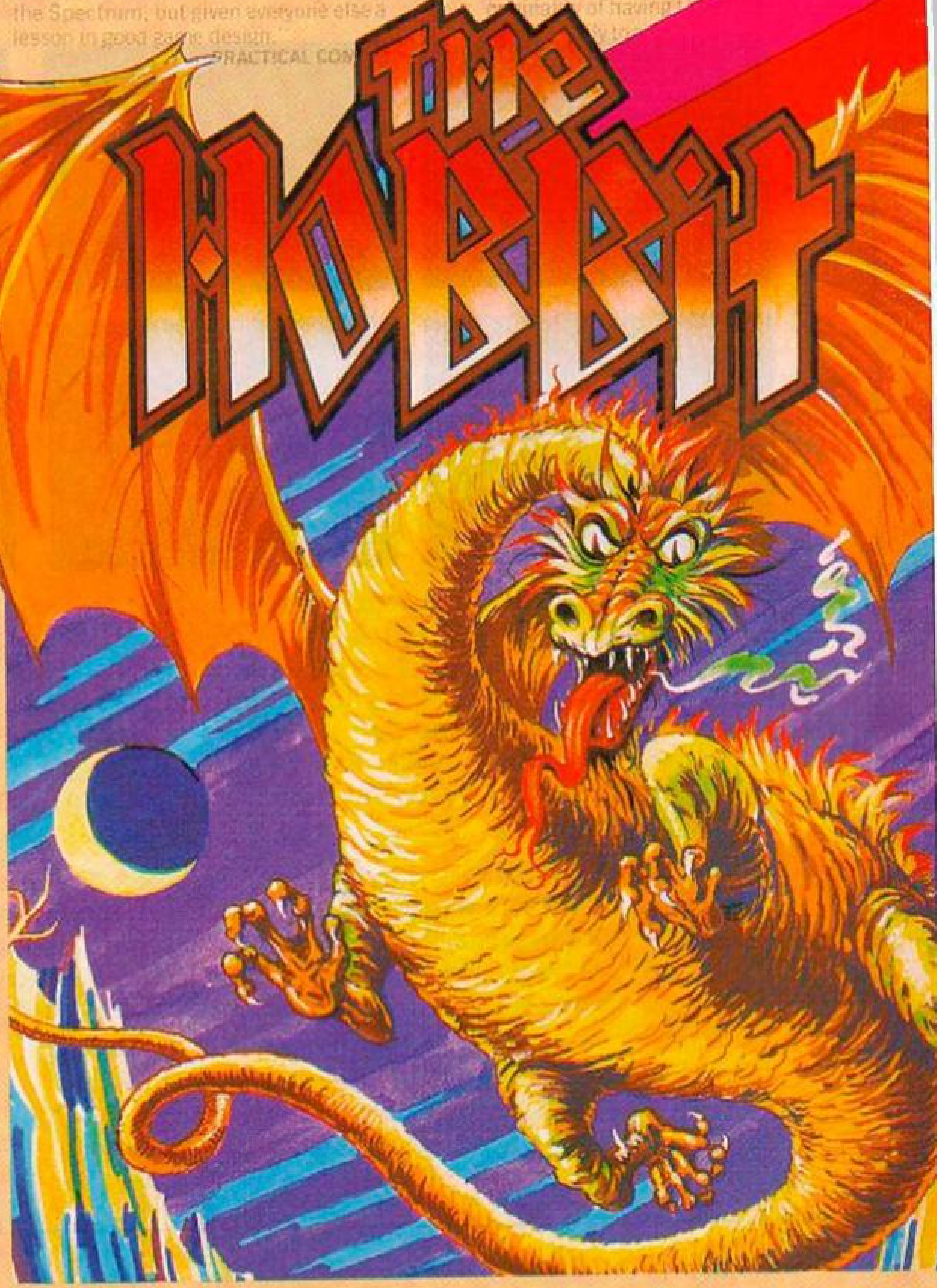
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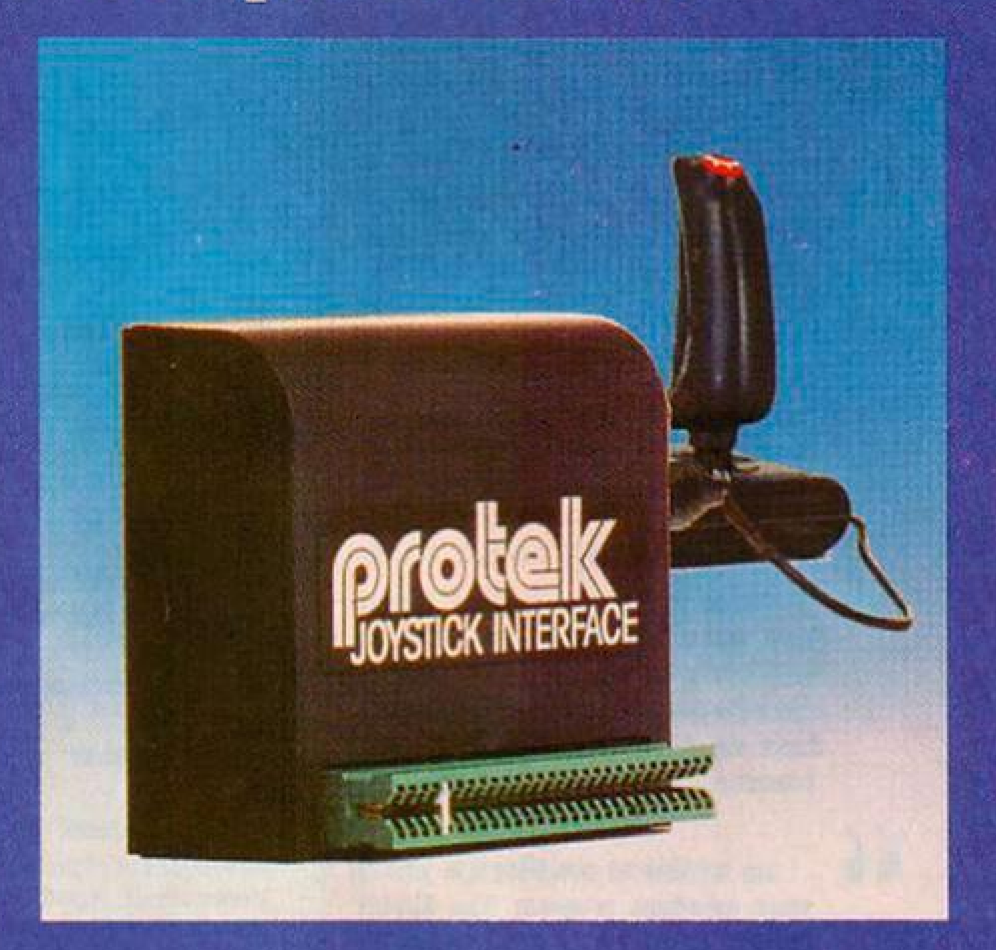
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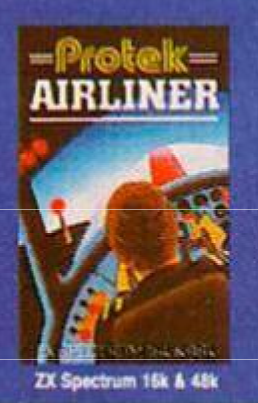


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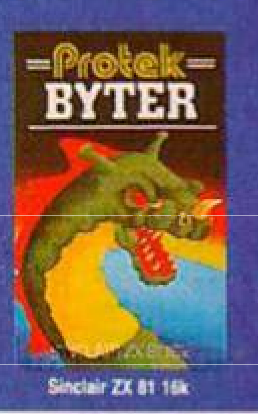
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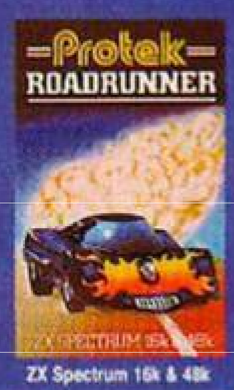
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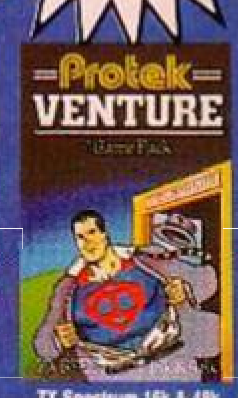
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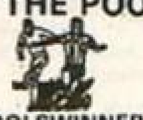
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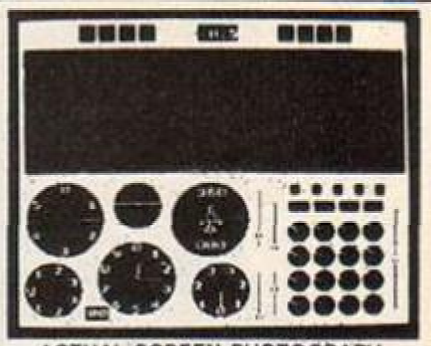
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Local, national and international micro events are updated here. To publicise your event, phone Paul Bond on 01-661 3472.

Which Computer Show

No-one under 18 is admitted to this business and systems software biased show. It is on at the NEC in Birmingham from 17-20 January, and, if they'll allow you in, it is open from 10 till 5 except on the Friday, when it closes at 4pm. It would cost you £3 if you turned up on the doorstep, but just between you and me, you can get a free complimentary ticket if you phone Clapp & Poliak Exhibitions on 01-747 3131 and ask politely first.

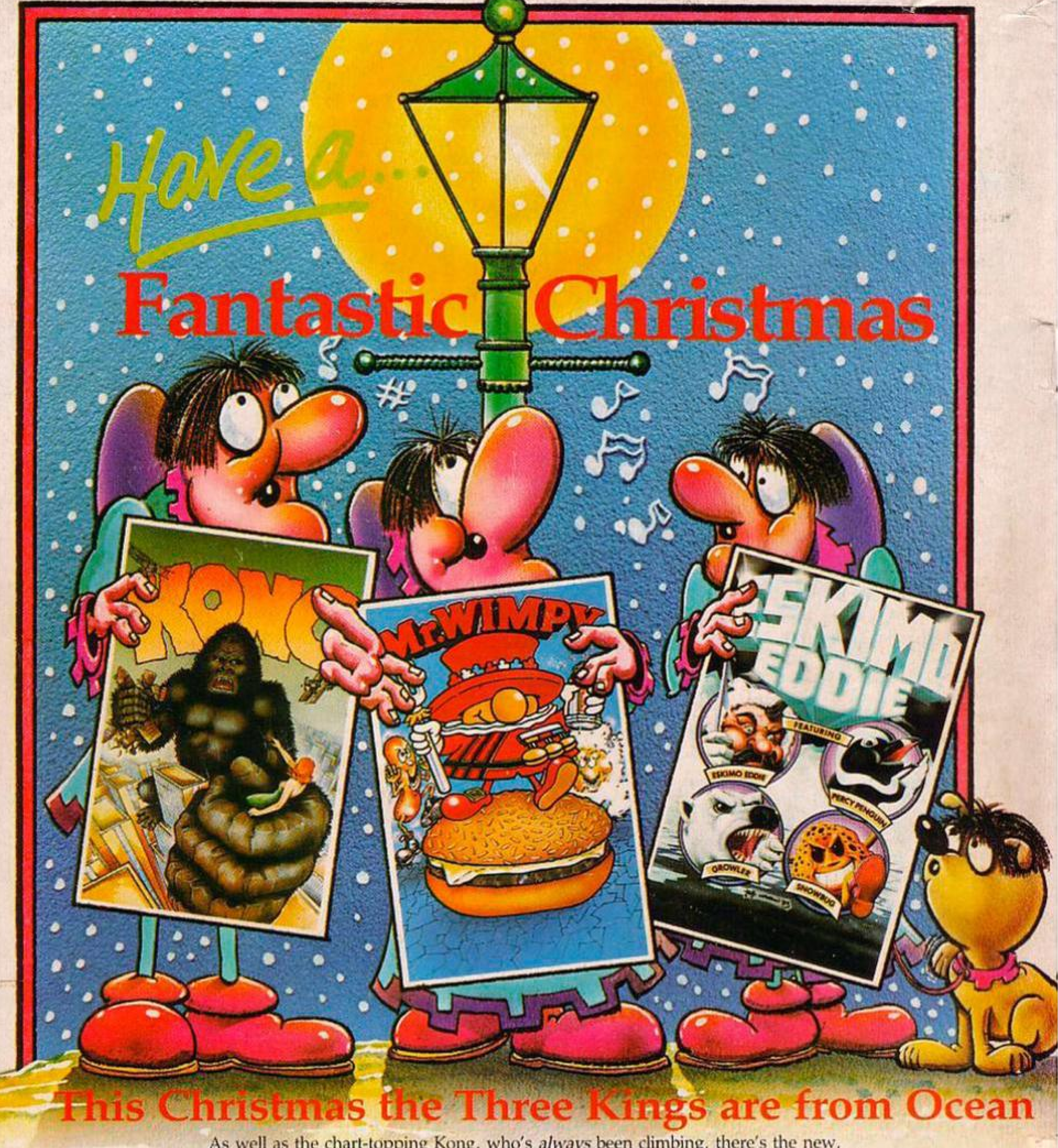
Acorn Education Show

In a month of pretty exclusive exhibitions, here's one for teacher. It is by invitation only, but inside Central Hall Westminster between January 25-27, there will be over 60 companies dealing in Acorn-related services and peripherals, with an educational bias. The show is organised by Computer Market Place Exhibitions Ltd, who can be contacted on 01-930 1612. Apparently Sinclair will be doing something along the same lines in March.



Roz Evitts left director of Visions Software Ltd. and managing director Sean de Bray claim sales of 60,000 in "a few months". Above they're all set to prove that Visions is not a fly-by night outfit

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This Christmas the Three Kings are from Ocean

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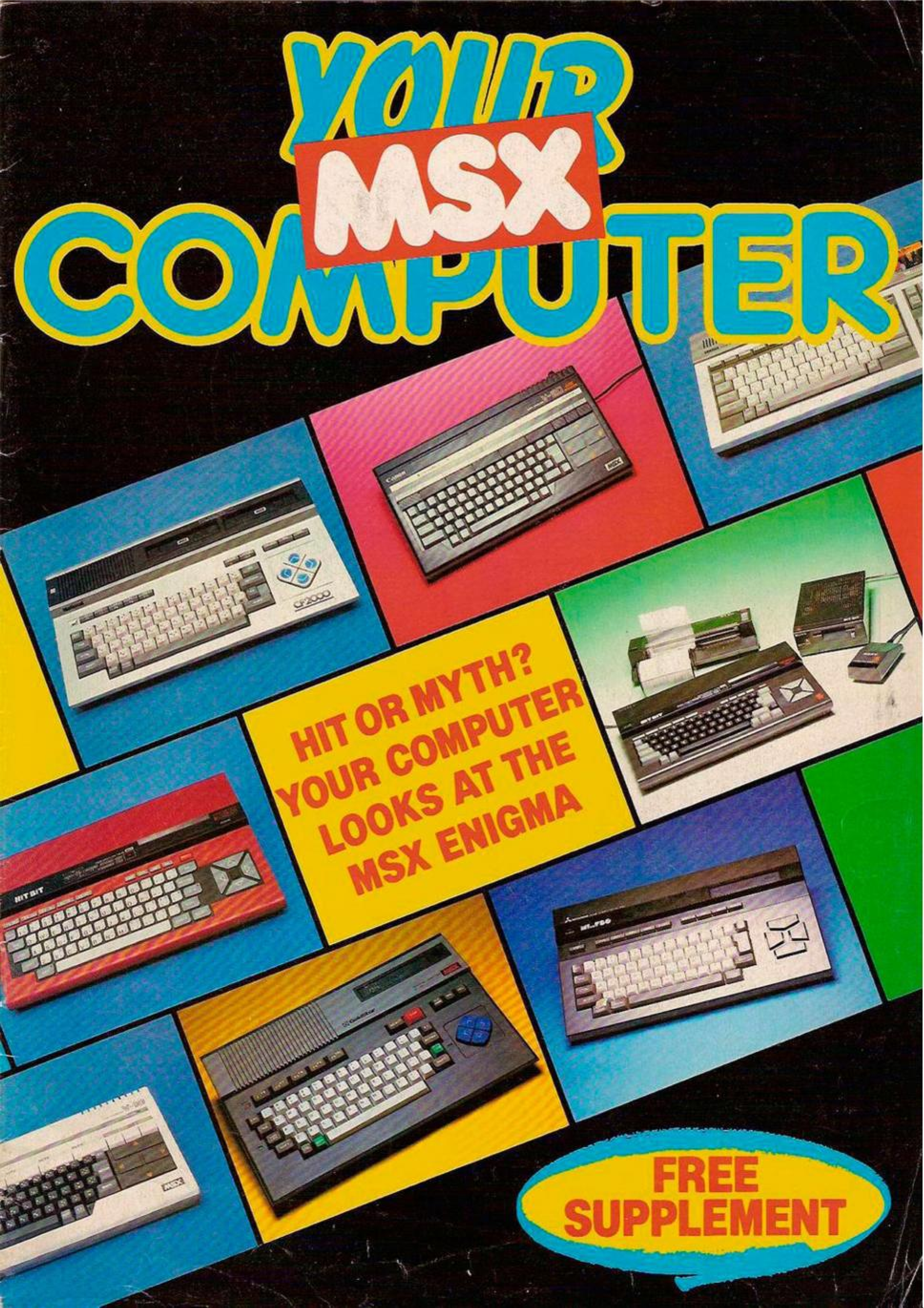
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Everything you wanted to know about MSX, but was afraid to ask

WE ARE now experiencing the biggest shake-up to hit the computer world in years. By this time next year we shall know if the three letters MSX are to rival IBM in computer importance, or if they merit just a footnote in tomorrow's history books. It is interesting to note that the Great British computer buying public are to be key figures in the MSX story. If we take to these standardised computers then MSX will go on to greater things elsewhere. If on the other hand the British public spurn the advances of much respected names such as Sony and Yamaha then the Japanese will have to think again.

Much has already been said about the possible success of MSX. Some pundits have sneered saying that it doesn't have a chance, others have staked their futures on the standard. The wisest remain aloof, waiting to see what happens. After all, there are so many ifs. The truth is that it can succeed provided that the manufacturers get their act together, and the software houses throw their full weight behind them. And that is a big if.

MSX, Micros and Modems

SONY HAVE just developed a smaller, cheaper compact disc player, that computer users will find very interesting. A disc usually contains thousands of bytes of digital information representing music, but there is no reason why the information stored on such a disc couldn't be computer data, or even programs. At £279.95, the player is going to be a little expensive for the average user to buy and connect up to his MSX micro while waiting for software to appear, but then you can't buy Elton John discs for a 3 inch floppy drive.

If it arrives, compact disc software will really appeal to the software houses, as it can be made difficult to pirate, though music pirates love CD as it gives them a perfect master to copy off. But it offers the user a lot of advantages. For a start it is very quick, and each disc can store vast amounts of data, best of all, compact discs are uncorruptable. Later this year there will be read/write CD units available, and who knows maybe software with stereo music.

Coming to save the world.

GHOSTBUSTERS HAS already been a worldwide smash-hit record. Before long the film will be breaking box-office records and no doubt the new video game will be the first MSX game to hit the number one position. Coming to a TV screen near you soon, Ghostbusters is available on cassette from Activision. The game has elements of adventure, strategy and arcade action and has been written by David Crane, the brain behind Pitfall and Decathlon.

Ghostbusters — the video game is based on events in the film and features some of the music and characters together with some surprises. Other MSX games from the Activision stable include Beamrider, Decathlon, Pitfall II, River Raid, Space Shuttle and Zenji. All six come on cassette and cost £11.99 each.



CD for MSX

COMPUTER communications is the in-thing at the moment, everyone seems to be connecting up Modems, and running up massive phone bills. Amongst the various services available are British Telecom Gold which is an electronic mail service, the Nottingham Building Society "Homelink" system which offers home banking and shopping facilities, and services such as Compunet and Micronet. These last services are especially designed for home computer users and often have a large amount of free software available for downloading.

To use such services with an MSX computer you need: an RS232 interface, a modem and some operating software . MSX Viewdata from Kuma Computers is just such a software package. It allows the saving of Viewdata frames, and the off-line preparation of messages, and it also works with the Telex service. Anyone who has seen the film "War Games" will know what fun you can have with micros and modems, so for more details ring Kuma on (07357) 4335. You don't need a modem to speak to them yet.

CONTENTS





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THE MSX STORY SO FAR . . .

THE HOME COMPUTER industry has spent the last few years running around in circles. Each of the dozens of home computers has to have its own software especially written for it. Even different models from the same company can't use each other's software. This is set to change, thanks to the Japanese.

Over a dozen Japanese companies including Sony, Canon, Sanyo, JVC, Hitachi, Toshiba, Mitsubishi, Teleton and Yamaha have got together and agreed a standard for home computers. The standard is called MSX and the first microcomputers which meet it are now on sale in the high streets at prices a little under £300. Each model will be able to use software and accessories intended for the others. This would simplify life for micro owners, but rival computer makers say the MSX standard is already old fashioned. They also fear it could allow the Japanese to dominate the UK computer market.

The MSX story began in 1983 when several well known Japanese companies were planning home micros. Each asked Microsoft for a version of Basic for its computer. The version Microsoft produced was called MicroSoft eXtended Basic, or MSX Basic. From here the idea of producing machines which were fully compatible evolved and other Japanese companies were pulled in to agree to the standard. This took the name MSX, even though it went much further than just having the same Basic.

There are good arguments for standardising. It would be absurd if each hi-fi company produced record players which needed different types of record, yet this is just what happens with home computers.

!There are three main types of microprocessor in common use, the Z80, 6502 and 6809. Each understands its own set of machine code instructions, so a program written for one has to be totally re-written for the others. Even computers which use the same microprocessor arrange the display, keyboard, sound, memory and so on in quite different ways, so considerable work still has to be done to convert software. This means software is only produced for the top selling models.

Without a good range of software a microcomputer is little use. Several promising computers have failed because the companies which write software haven't bothered to produce any for them. If the Japanese companies had each produced different machines, they would have had a hard time getting software. Because they all use the same software there should be lots available.

Until now Japanese companies have made little attempt to sell home micros, for which no standards exist. The only ones to have reached the UK was the unsuccessful Sord M5 and the Sharp M2700. On the other hand they have done quite well selling business micros, for which there are two clear standards. By establishing the first home computer standard they could clean up.

The details of the MSX standard were drawn up by Microsoft. The main inspiration coming from Kay Nishi, the head of the Japanese division of Microsoft. All companies making MSX micros pay royalties and a hefty licence fee to Microsoft. Non Japanese companies are also taking out licences to build MSX micros, helping it become an international standard.

All MSX micros and software should carry the MSX logo. This is guarantee they meet the standard, so MSX owners can buy with confidence. Software really is interchangeable between different makes, both cartridges and tapes. At first being able to pull a cartridge out of a Sony and use it on a Toshiba seems amazing. After a few days using MSX micros it seems amazing that other computers can't do the same.



To achieve software compatibility meant virtually designing an entire standard computer. Designing microcomputers is largely a matter of choosing a combination of computer chips and then fitting them together on a circuit board, with a case and keyboard to go around them. The MSX design specifies chips which include the Zilog Z80 microprocessor, Texas Instruments 9918A display chip and the General Instruments AY-3-8910 sound chip, or their equivalents. It also specifies MSX Basic, standard keyboard functions, a cartridge socket, a cassette tape standard, one Atari style joystick socket and other details.

Each company is left to come up with its own keyboard and case styling. They also have some freedom over the other features included in each computer. The minimum MSX standard only insists each machine has 8K of main memory plus 16K of memory which is dedicated to the screen display. Almost all machines coming to the UK, however, have 64K of main memory, making a total of 80K including the screen memory. They also have a Centronics printer interface and a second joystick socket, neither of which has to be included in an MSX micro.

Some companies are building more specialised features into their machines. The Sony Hit-Bit MSX micro has a built-in database program. Yamaha's CX5M goes further and includes a high quality FM polyphonic synthesiser and piano-style keyboard. Add-ons such as disc drives and an RS232 interface can be added via the slot for cartridge software, which also acts as an expansion port.

MSX Basic is one of the best versions of Basic around, and is far better than found on popular micros such as the Spectrum and Commodore 64. It includes some powerful graphics and sound commands. The graphics commands include full control over 32 sprites. This makes it easy to write games, which could be mistaken for programs written in machine-code. All calculations are done to a much higher accuracy than normal. Ten functions can be programmed into the function keys and the computer displays a label for each key on the bottom line of the TV screen.

A wide set of other useful commands are included, plus some which are revolutionary. MSX Basic includes a full set of "event handling" commands. These can be made to interrupt a program when the joystick fire button is pressed, two sprites collide, a function key is pressed or at regular intervals. This makes the programmer's life much easier. For example, rather than writing a program so it repeatedly checks to see if a fire button has been pressed, just one command is needed to automatically send it to a subroutine when the button is pressed.

Although most MSX micros have 80K of memory, only 28K is free for use by Basic programs. A full 64K of memory is only available when using disc drives.

Graphics are produced with a resolution of

256 by 192 cots in 16 colours. There can only be two colours in each row of eight dots which is a standard limitation of the 9918 chip.

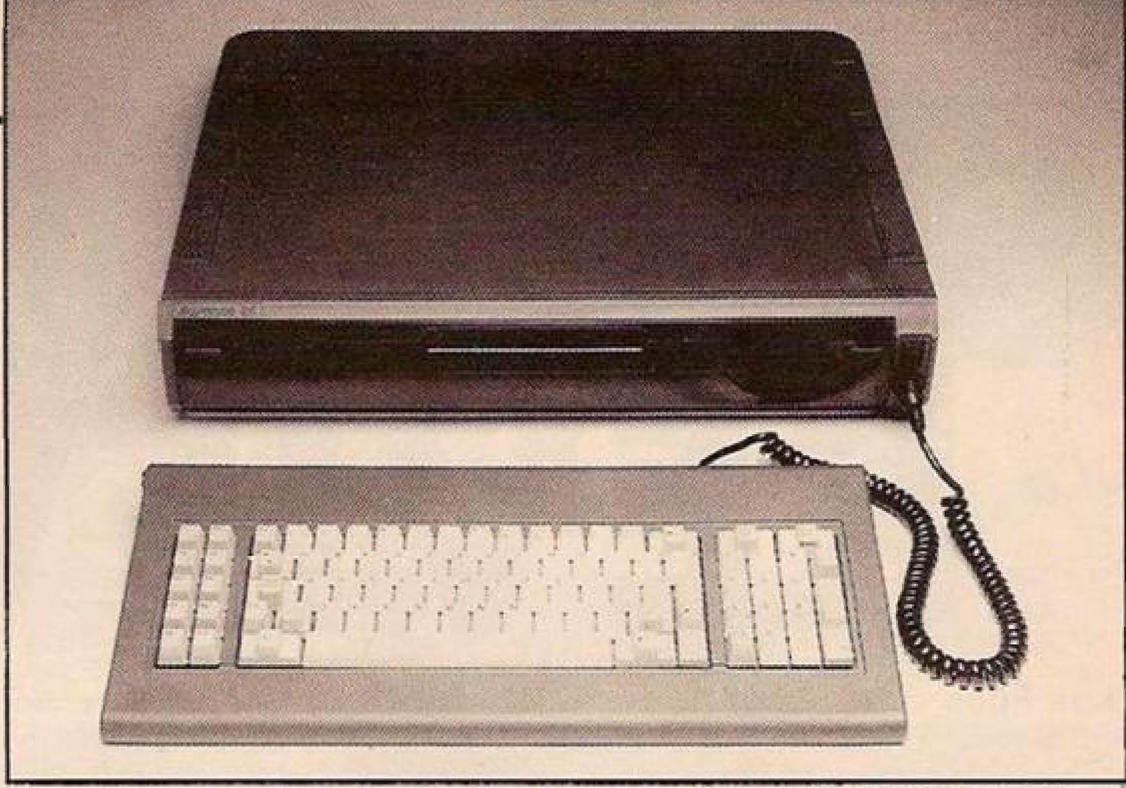
Perhaps the most controversial part of the MSX standard is the Z80 microprocessor. At over seven years old, this 8-bit chip is almost prehistoric by computer standards. Other computer makers say standardising on such an old microprocessor is a mistake when the latest designs could be used instead.

Yet the Z80 microprocessor is well known and is still used in many business and home computers. The latest UK computer, the Enterprise, uses the Z80 and Commodore's latest two home micros use a version of the 6502, a microprocessor of similar vintage.

Only two home computers have appeared with anything other than 8-bit microprocessors. One is the Advance 86a which uses a 16-bit microprocessor similar to the IBM PC's, allowing it to be expanded to use IBM PC software. It has not been popular as a home micro, however. The other is the controversial Sinclair QL. This uses the Motorola 68008 which has variously been described as a 32-bit, 16-bit and glorified 8-bit microprocessor. Despite using the latest technology, the QL is slower than many 8-bit micros.

Any standard tends to inhibit progress. As developments in computing happen so quickly there is a real danger the MSX standard will be left high and dry in a couple of years time.

The companies behind MSX say it will not go out of date because it will be able to switch to more advanced chips, such as the 16-bit Z800 microprocessor and the 9229 graphics chip. These are new versions of the chips in the MSX standard. They should be able to use all the old MSX software plus new software written to use their extra features. For example the 9229 chip allows an 80 column



screen display as well as the normal 40 columns.

There is also due to be an MSX disk drive using a system known as MSX-Dos. This is similar to CP/M, but is able to exchange data (though not programs) with MS-Dos computers, so people will be able to take work from a 16-bit computer at the office and continue at home on an MSX micro.

The companies bringing MSX micros into the UK have formed the MSX Working Group to maintain the standard. The Group expects 85,000 MSX micros to be sold in the UK by Christmas and world wide sales of 780,000 next year, although estimating computer sales is a tricky business. MSX is claimed to have sold around 300,000 in Japan since its launch there in autumn 1983 and to now have 40 per cent of the market.

The UK has been chosen for MSX's first foray outside Japan because it has the highest ownership of home computers in the world.

Companies outside Japan are starting to take out licences for MSX. Spectravideo, a joint American and Hong Kong company produced a micro called the SV-318 which was a virtual prototype for MSX. Now the company has a true MSX micro. Philips is the first European company to announce an MSX micro, but it will be selling it in Italy and perhaps Germany before bringing it to the UK next year. GEC could become the first UK company to produce an MSX micro, it has bought a licence but has not yet committed itself to building anything. About 20 companies around the world have announced MSX micros and more will soon join the club.



The MSX standard makes it possible for lots of companies to launch home micros because they are guaranteed a range of software for them. Many UK software houses are converting their existing programs to run on MSX micros. This will make it possible for well known electrical companies which don't build computers to get into the business. It may also mean own brand home computers from chains such as Boots and Dixons.

Surprisingly the Japanese are not using the latest technology to build MSX micros. Each machine uses many computer chips. UK and US companies keep costs down by combining the functions of many of the simpler chips onto a single chip especially made for each micro, which is called an uncommitted logic array (ULA). The present MSX micros don't use ULA's which is one reason their prices are higher than expected. Indeed the demand for chips by MSX micros has helped make the world shortage in computer components worse and so push up prices further.

Cheaper MSX micros may be produced by using ULAs, or this stage may be missed out in a plan to go straight to a superchip combining all the major chips specified by the MSX standard. This would be more advanced than any chip used in home computers, allowing low cost computers to be build from just a few chips.

The strength of MSX is not that it is bang up to date, but that it is a well thought out standard with lots of features which make MSX micros pleasant to use. It is aimed squarely at the bottom of the market but has none of the major faults of existing micros, such as poor keyboards, small memories, poor versions of Basic, poor displays, no add-ons or little software. If there is going to be a standard, MSX is quite a good one.

SOFTWARE REVIEWS

Les Flics
PSS

LIKE MOST of the home grown MSX software, Les Flics is a conversion of a popular game from another micro, in this case the Sinclair Spectrum. It is an arcade action game that, though it never says so, gets its inspiration from the famous Pink Panther movies. Whoever wrote the mock French notes on the back of the cassette should be shot, but they manage to set the tone for what is essentially a fun game.

Les Flics is the French nickname for the "Old Bill", the game of the name, or the name of the game is about avoiding them as you guide a pink panther around a map of Paris. There are two parts to the game, a car chase around the streets, and a more conventional arcade chase-about inside the buildings. There are nine buildings to choose from, and they each contain objects to help you commit the crime of the century.

Like any other supercrook, you need food to keep your strength up, ignore it and you die; however you may only eat while you possess the knife and fork. Keys let you open doors and so on. In a way Les Flics is like an Arcade Adventure, in the same genre as Atic Atak, though it is somewhat less sophisticated.

Rating ***

Holdfast
Kuma

HOLDFAST IS the first overtly political game for the MSX computers. In the game you lead a village's campaign for a school and a clinic. The hypothetical country that the game is set in is called Dictatoria, but might as well be Great Britain. There is a slight, but only a very slight, resemblance to Hamurabi, or Kingdoms, though your aim is not to manipulate stocks of grain and raise taxes, instead to have to manipulate public opinion, and get it on your side.

On the surface, Holdfast is a mildly amusing computer parlour game. But under the surface lies something far more significant: a message. Fortunately the message, and the lesson learnt from playing the game, is a fairly sound one: If you want to get things done, organise peaceful campaigns. As such this is a laudible sentiment, yet suppose someone with a darker motive was to try and "teach" in this manner. What if the National Front put out a similar game where you win by persecuting a minority?

No doubt Holdfast was meant to be controversial but that doesn't stop it being fun. Destined to be a smash-hit with Guardian readers, CND members and anyone who doesn't like the government.

Rating ***

Eric and the Floaters
Kuma

ERIC AND the Floaters sounds more like a rock band than a computer game. Either way, Eric and his friends are not going to top any charts. Eric is a little man trapped in a maze and he is being chased by the "evil" floaters. Though they don't look all that evil, they resemble party balloons, and some of the time their little faces smile.

The object of the game is to kill all the floaters, pick up some treasure, and find the door to the next level of the game. Killing all the floaters on one level sends you to a more difficult level, either with more floaters, or with automatic bomb laying. The delayed action bombs are your only weapon against the balloon baddies. Personally I found myself sympathising with the baddies.

Rating **

Shark Hunter
Electric Software

ESKIMOS HAVE a hard life, all that snow and ice, aggro every few months from Greenpeace and all those trainee salesmen trying to flog them fridges. However such tribulations bring rewards, and the Eskimo is the star of a surprisingly large number of MSX games. In one of them, Shark Hunter, our friend the Eskimo has a Herculean task on his hands, keeping the sharks away from his fishpens. All through the spring, summer and autumn, he struggles to keep the sharks away, so that Ms Eskimo and little baby Eskimo can eat through the long dark winter.

The Eskimo can be controlled by either the joystick, or the cursor keys, and he must dash about mending nets and throwing harpoons at the big bad sharks. To mend the nets he has to swim in the sea, and if you don't watch out, he becomes a meal for the sharks. Shark Hunter is a gruesome, but addictive, game and will appeal to all the family, unlike most other computer games.

Rating ****

Driller Tanks
Kuma

DRILLER TANKS is not the best MSX game to date. It involves burrowing a tank deep into the earth beneath a building that looks remarkably like Brighton Pavilion. Naturally there are some nasty creatures living in the tunnels that get dug, and naturally they can either get you, or get zapped by your tank's water cannon — well that's what it looks like.

Points are scored for dispatching the hostiles, and for progressing around the maze-like tunnels. There are eight screens of tunnels for you to get utterly bored in. Driller Tanks makes watching Crossroads seem like worthwhile activity. Avoid this game, it is the software equivalent of a lullaby.

Rating *

Maxima
PSS

MAXIMA IS billed as a "pure arcade game", so it will appeal to the shoot-'em-up brigade. It is the kind of game that is best played with a joystick, and better still if you have some friends along to join in the alien blood-letting. Like most of these shoot-'em-ups, Maxima is effectively space invaders with knobs on.

There are 16 different waves of nasties to zap, and the smooth graphics, sound and movement is all very nice, but ultimately Maxima is unsatisfying. There is no aim other than to create lots of alien orphans, and no real reward for all your efforts. Still if you never caught space invaders first time around, then this might appeal to you.

Rating **

Sparkie
Sony Hit-Bit cartridge

SPARKIE IS a very original game. It puts the lie to the story that the Japanese can neither program, nor come up with, innovative ideas. Although on the surface it does bear a passing resemblance to Pac-Man, the game has much more depth, and an equally odd theme. Sparkie is a bomb, the old fashioned type, complete with a fuse. He lives in a maze, which is crawling with mobile cigarette lighters and matches. These chase Sparkie and if they connect, Kerpow! he explodes.

Fires burn, and to make things worse every

(continued on page 18)

the only choice Kuma MSX


Eric and the Floaters


Binary Land


Driller Tank


Fire Rescue


Hyper Viper



Database



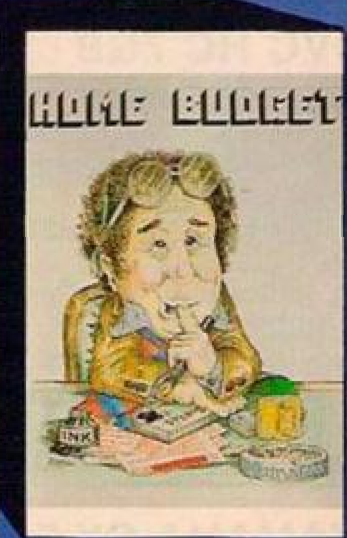
ZEN Assembler



WDPRO



Kuma FORTH



Home Budget

An outstanding selection from Kuma's rapidly expanding range of Entertainment and Application Software for the MSX Micro-computer.

Books:

- **Starting with the MSX**
- **The MSX Red Book**

Accessories:

- **RS232C Interface**
- **Speech Synthesiser**
- **Parallel Interface**





Available from larger branches of



and selected branches of Co-op, Granada, Laskys and John Menzies.

THE SAME BUT DIFFERENT

MSX micros offer the same basic specifications but choosing one isn't as easy as it appears.

CHOOSING A MICRO is never easy, choosing MSX micros is even more difficult. This is because there isn't much to choose between. All machines offer the same fundamental specification, though certain models might have differing amounts of memory. This leaves three criteria; manufacturer, price and the extras offered.

You might think that the cheapest machine is the best buy, after aren't all MSX machines the same anyhow? But the big name manufacturers claim that their machines will sell purely on the strength of the labels attached to them. The big names boast that they can offer customers a better back-up service, or a more reliable machine, or in some cases a prettier box around the computer.

Whatever manufacturer you choose, the price is going to be important. MSX micros are not exactly cheap when you consider their specification. Yet some machines are better value than others. Lastly comes the extras, these vary from Yamaha's mini piano keyboard and music software, to Sanyo's lightpen interface. On the whole you can expect to pay more for a machine with extras than for a bare-bones MSX micro.

In addition to the machines in the buyer's guide below, are a number of other machines not yet announced in the UK. Most of the manufacturers are cagey about releasing details, they want to wait and see how these machines sell first. Amongst those planning first releases are Phillips, who have already released a MSX micro in Italy, but say the specification is too unsophisticated for the UK market. Fujitsu, Japan's biggest computer manufacturer, have a micro coming, but not yet. Teleton would be shipping machines now but is having problems with quotas.

SPECTRAVIDEO SVI 728

Contact Address: Spectravideo Ltd., 165 Garth Road, Morden, Surrey SM4 4LH.
Telephone: 01-330 0101.
Prices: £249
Specification: 64k Ram.
Availability: Out now in some electrical shops.

JVC HC 7GB

Contact Address: JVC House, 12 Priestly Way, Eldonwall Trading Estate, Staples Corner, London NW2 7BA.
Telephone: 01-450 2621.
Price: £279
Specification: 64k Ram, second cartridge slot
Availability: November 84, JVC will be selling the HC 7GB through their nationwide network of hi-fi dealers.

See figure 1.

YAMAHA CX-5

Contact Address: Kemble Yamaha Ltd., Mount Avenue, Bletchley, Milton Keynes, Buckinghamshire MK1 1JE.
Telephone: (0908) 640202.
Price: £600.
Specification: 48K Ram. The Yamaha CX-5 is sold primarily as a musical instrument, it comes complete with a three and a half octave piano keyboard, and a built-in synthesiser. The CX-5 also has a midi-interface. There are 48 pre-set voices and can play either monophonically or in 8-note Polophony. (See main magazine for full review.)
Available: Out now, but sold through music shops.

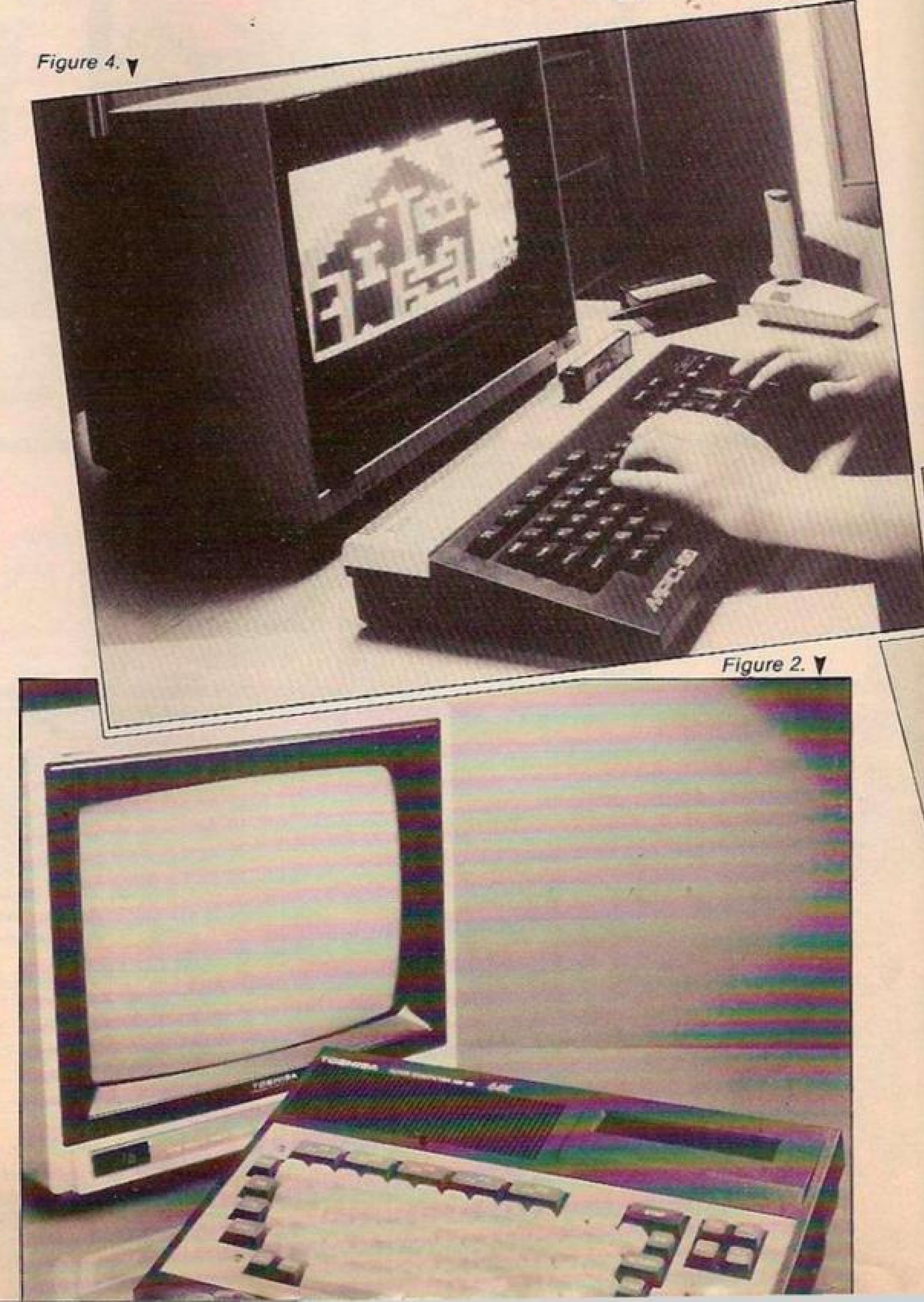


Figure 4. ▼

Figure 2. ▼

TOSHIBA HX-10

Contact Address: Toshiba (UK) Ltd., Toshiba House, Frimley Road, Frimley, Camberley, Surrey GU16 5JJ.
Telephone: (0276) 62222.
Price: £279.
Specification: 64k Ram
Availability: The Toshiba is already available in a number of high street stores.
See figure 2.

CANON V-20

Contact Address: Canon (UK) Ltd., Canon House, Manor Road, Wallington, Surrey SM6 0AJ.
Telephone: 01-773 3173.
Price: £280.
Specification: 64k Ram.
Availability: In shops from November '84.
See figure 3.

SANYO MPC 100

Contact Address: Sanyo House, 8, Greycaine Road, Watford, Hertfordshire WD2 4UQ.
Telephone: Watford 46363
Price: £299.
Specification: 64k Ram, special light-pen interface. Two manuals and two introductory cassettes.
Availability: Out now in high street stores.
See figure 4.

GOLDSTAR MSX

Contact Address: Microdealer UK Ltd., Burrowfield, Welwyn Garden City, Herfordshire.
Telephone: (07073) 28181.
Prices: £230.
Specification: 64k Ram.
Availability: Through specialist computer shops.
See figure 5.

SONY HIT-BIT

Contact Address: Sony (UK) Ltd., Sony House, South Street, Staines, Middlesex. TW18 4PF.
Telephone: Staines 61688.
Price: £299.
Specification: 64k Ram, second cartridge slot. An extra 16k ROM contains special built-in software which can be used with CMOS battery powered RAM to provide database facility. Software includes; Address Book, Memo Pad and Schedule Reminder. Supplied with three manuals.
Available: Out Now.
See figure 6.

MITSUBISHI ML-F 80 and ML-F 48

Contact Address: Mitsubishi Electric (UK) Ltd., Hertford Place, Denham Way, Rickmansworth, Herts, WD3 2BJ.
Telephone: Rickmansworth (0923) 770000.
Prices: ML-F 80 £299; ML-F 48 £249.
Specification: ML-F 80 has 64k Ram, ML-F 48 has 32k.
Availability: November 1984, available throughout Mitsubishi TV dealers.
See figure 7.

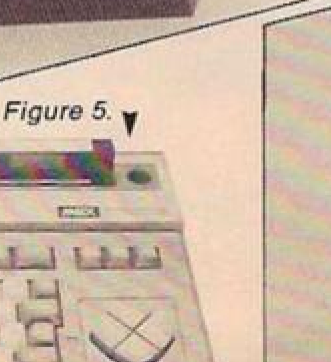
Figure 7. ▼

Figure 3. ▼

Figure 6. ▼

Figure 1. ▲

Figure 5. ▼





The new Mitsubish

For those in the know

Anyone conversant with home computers will know precisely why MSX was worth waiting for.

The sheer proliferation of computer and software systems flooding the market loudly underlined the need for a unified standard.

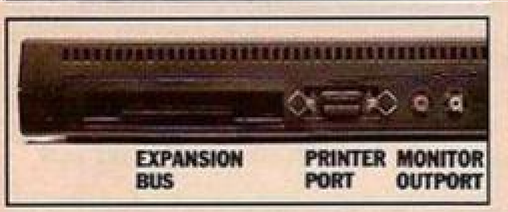
So the major companies jointly developed a single computer and software system. The result – MSX – the format that will be standard for all time.

And those in the know will not be surprised that Mitsubishi are in the vanguard of the MSX movement. For, with the F-series, Mitsubishi offers everything that MSX is and more.

GRAPHICS

Maximum resolution of 256 x 192 pixels with all 16 colours available on the screen at the same time. 32 sprites in two sizes and two magnifications allowing easy creation of '3D' graphics. 255 pre-defined characters all of which can be used as straight text or easily mixed with graphics.


JOYSTICK AND CASSETTE PORTS


EXPANSION BUS PRINTER PORT MONITOR OUTPORT

SOUND

Three independent channels which can be output through the TV loudspeakers at any volume, individually or simultaneously, at any of the available 8 octaves. All three channels can use the 'noise' generator for stunning sound effects.

KEYBOARD

73 moving keys, ergonomically designed for many hours of fatigue free use. Large cursor control keys which are excellent for both programme editing and game playing. 5 function keys giving 10 pre-defined functions which can easily be redefined from 'BASIC' using the 'KEY' command.

BASIC

MSX BASIC is possibly the most comprehensive version of the original language. There is a complete set of commands for creating graphics and sounds, manipulating text and moving sprites. In addition to this there are 'built-in' interrupt routines for detecting sprite collisions, function key selections and joy-stick fire buttons.

EXPANSION

The Mitsubishi 64k ML-F80 and 32k ML-F48 are both equipped with 2 cartridge ports, 2 joy-stick ports and a centronics compatible parallel interface. It is through these devices that the MSX system can be expanded for use with disc-drives, printers, serial interfaces, modems and other peripherals.

SOFTWARE ON CASSETTE

The MSX system can load and save data onto cassette at 1200 or 2400 baud and unlike certain other home computers, the Mitsubishi F-series can be used with a normal domestic tape recorder for this purpose.

When you put all of these features together, with the knowledge that Mitsubishi is the largest manufacturer of Mainframe computers in Japan, those in the know will immediately recognise the true potential of the Mitsubishi F-series.





i MSX Computers

For those who aren't

The Mitsubishi MSX family computer is everything you wanted to know about computers, but didn't know who to ask.

It's friendly, it's fun and so simple, a grown man can use it. Yet so versatile even his computer-versed children would be hard-stretched to over-tax it.

It operates with any colour TV set. Just plug it in, and the full power of the computer is instantly at your fingertips.

FOR FATHER

The Mitsubishi MSX can do many things, from keeping a simple check on the bank balance to running a complete business with customer account files, stock control programmes and word processing. It is just as much at home keeping control of your record or stamp collection or playing 'strategy' games such as chess, othello or contract bridge.

FOR MOTHER

There is the opportunity to store recipes and other household information or keeping record of the children's progress at school. Household accounts can also be recorded so that savings can be planned for holidays and other seasonal expenses.

FOR THE CHILDREN

There is education, particularly computer education. In a world where computer literacy is now of foremost importance, MSX offers a broad base of educational software. With simple programmes for the very young through to complex programmes for older students like language learning.

Also, the graphics system of the Mitsubishi computer ensures that the MSX versions of your favourite games are reproduced with incredible speed and accuracy.

Undoubtedly, MSX is the format for the future, and will become the byword for computer education and entertainment.

And you can be secure in the knowledge that regardless of future developments, any investments made in MSX hardware, software and peripherals today will always be compatable with the Mitsubishi F-series.

So if you've waited until now to buy a computer, you couldn't have timed it more perfectly. Get to know one today.

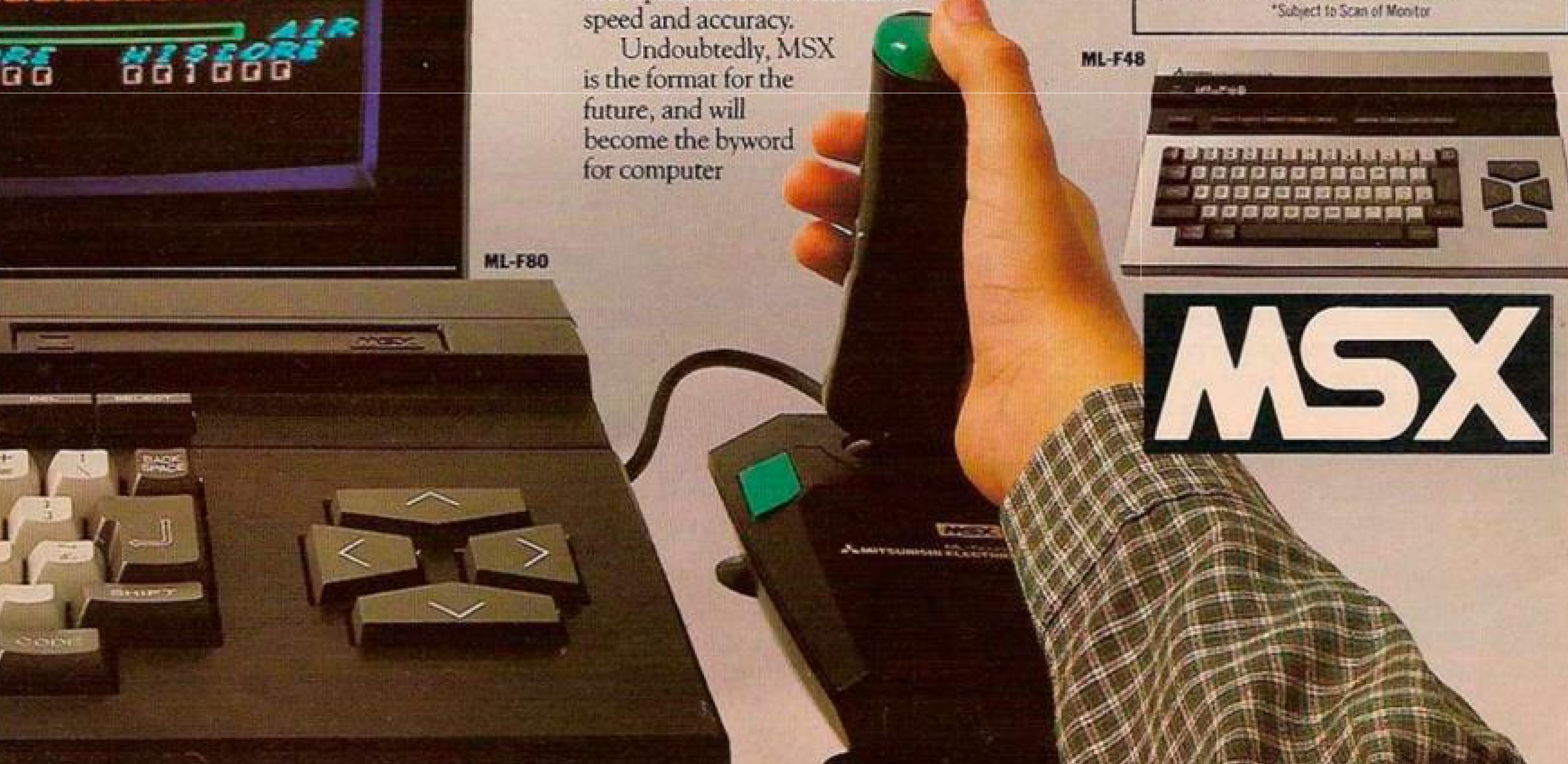


Mitsubishi Electric (UK) Ltd., Hertford Place, Denham Way, Rickmansworth, Herts WD3 2BJ. Tel: 0923 770000.

SPECIFICATIONS

CPU:
Z80A (3.6 MHz)
Memory:
ROM: 32 KB
RAM: 64 KB (F80)
RAM: 32 KB (F48)
Video Ram: 16 KB
Screen Displays:
*Text Mode:
40 columns x24 lines
*Graphics:
256 x 192 pixels
Colours: 16
(15+transparent)
Sprites: 32
Output: RF,
Composite Video
Keyboard:
73 moving-key keyboard
5 function keys
Cursor control keys
Special keys for screen editing
Sound:
8 octaves
3 channels for sound or 'noise'
Output by TV sound or External Audio Amplifier
Cassette Interface:
1200-2400 baud
Motor controlled by CPU
Parallel Interface:
Centronics
Joy-Stick:
2 x 9 pin connectors
Rom-Cartridge:
2 x 50 pin connector

*Subject to Scan of Monitor



PSS AND MSX



GARY MAYS, director of PSS is not certain about the future of MSX. His Coventry based software house is currently writing and converting software to run on the new standard, yet that doesn't mean he thinks the end-users are going to pick up on it. So why does PSS produce MSX software? "In the short term the multiple stores are going to stock MSX computers, and they will need some software to help sell the hardware.

"I have faith that the large stores will go for MSX. It is that kind of product. Holding MSX software greatly reduces their stock problems as they only need one set of software for a whole range of hardware. Whether the end-user will pick up on it remains to be seen. It will open up a totally new sector of the market, just as the Amstrad machine is doing."

Gary thinks that there is one question which the computer industry, both software and hardware, should address themselves to, "what do people want to do with computers?". Something useful no doubt, but he thinks that the software houses don't help the situation churning out one arcade game after another and expecting the public to be as enthusiastic as they were a year ago. "If the MSX manufacturers can answer this question then they will clean up".

A great deal of the computers sold these days are not to beginners, but are going to people who already own one micro and are upgrading. For example a lot of Spectrum owners are buying Commodore 64s. Gary Mays doesn't think the MSX computers are in that market at all. MSX computers are not likely to sell to people who know about computing.

Cambell MacCausland is the resident boffin at PSS, and he challenges the line put forward by the captains of the home grown computer industry, which claims that standardising micros on MSX is like freezing the development of the motor car at the Model T Ford stage. "It's nonsense, of course they would say that, after all, they are in competition with them.

"However the manufacturers have thought very hard about the specification. They chose the Z80 chip for the main processor and the Texas display chip for very good reasons. For example, Texas is currently working on a new chip which includes all the facilities of the current one, together with a whole lot more new functions. It will still work in MSX micros as it does at present, but when a few special signals are sent to it, a whole new range of capabilities will open up.

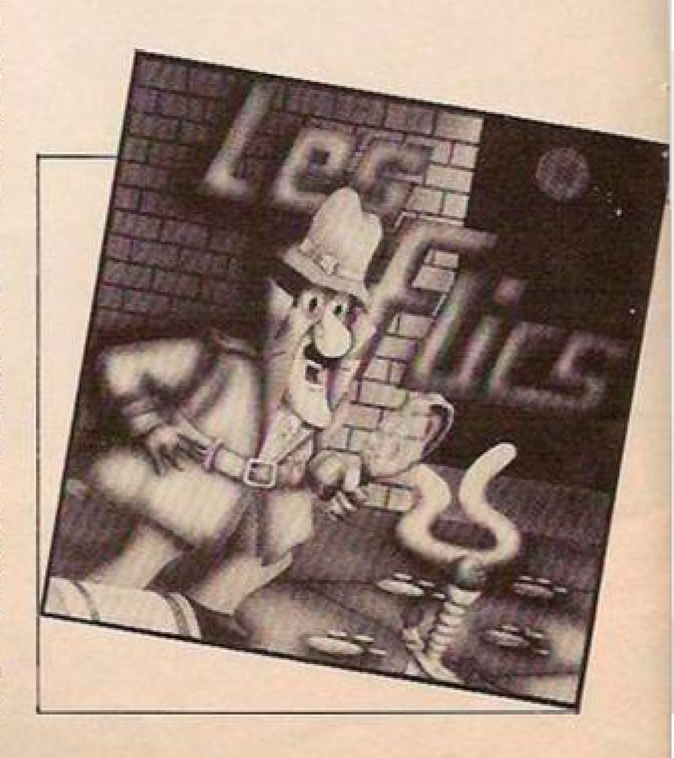
"In the same way, the processor that will go into any new MSX machines will be the Z800, which is totally compatable with the Z80. If MSX takes off, all the descreet chippery inside the computer will be compacted into a smaller number of chips, and that will bring the price of the machines down. I liken the MSX standard to a record player. If you buy a new computer your previous software tends not to run on the new machine, whereas if you buy a new record player, all old records will play on it.

"The method of making and playing records was developed back in the 1930s. In those days the players were crackly and very Model T-ish, but you cannot compare them with modern records and record players. The technology may have changed in many ways, but there is compatability. You can still play a 1940s record on a modern stereo."

At prices around the £300 mark, MSX computers are not cheap, and are definitely not good value, Gary Mays thinks this could be the biggest obstacle to the success of MSX. "The price isn't low enough to attract existing users — the kind of person who has a Spectrum or a ZX81 and is looking around for something a bit decent, with a real keyboard. The high price has a lot to do with the supply. Manufacturers cannot produce the numbers that a lower price would demand, so the price remains high. Once production steps up we can expect to see prices plummet."

But will Sinclair, Commodore and Acorn have to step into line? Gary Mays thinks not. "Sinclair are something special, a seperate entity. It would take something really stupendous to break his cult following." Yet the real answer to the question is more complex, for a start it depends on the software house. "If we can afford to develop a program across three or four machines, and that is unlikely, then Sinclair and Commodore can keep right on. To us the big advantage of MSX is obvious, you only need to produce one program. If MSX does take off, then we (the software houses) can get into cartridges, which would make life a lot easier all round.

Software companies like PSS have little direct contact with the hardware manufacturers. What does go on is mainly through the central MSX agency. In order to maintain compatibility across all the hardware, they have to follow very rigid guidelines. It is quite



possible that eventually the software will be tailored to one or two MSX computers, especially if only a couple dominate, but for now the programs stretch across the lot.

But surely all MSX computers are the same. Both Gary and Campbell don't think so, but admit that they are provided a programmer sticks rigidly to a set of BIOS calls — rather similar to the BIOS calls of CP/M. "Commodore make use of a similar system, which everyone seems to ignore. Once you depart from this and start calling things directly, you run into compatability problems." The MSX group advises software houses to stay within these guidelines, but that is rather like telling Picasso to stick to painting by numbers.

"One of the disadvantages of the BIOS calls", says Campbell, "is that for some machine-code, especially in an arcade game, you need speed. And going through the BIOS is not the quickest way of doing things. This unfortunately means that games software will be brought down to the best performance of the BIOS. On the Spectrum, a hit program is usually made by a programmer doing something which was previously thought impossible. That simply won't be possible with MSX machines."

Of the new MSX software from PSS, two games are conversions. "Les Flics" was originally on the Spectrum, and "Maxima" has been converted from the Memotech. Maxima is a "pure" arcade game, a fast shoot-'em-up in the Space Invaders vein. The Assembler/Monitor, one of the first MSX utilities, first saw the light of day in the "Home Computer Advanced Course" as a giveaway.

Before committing themselves to simultaneous releases of new software on MSX and Spectrum, the PSS people want to see what happens to the new standard. This attitude is common right across the industry, wait and see. In the short term both expect to see MSX users wanting the same kind of software as other computer users. Gary Mays has particular hopes for the Assembler, which he thinks will have a huge initial market as software houses, bedroom hackers and budding Jeff Minter's all try to produce software for the mushrooming MSX market. In the longer term though there will be a different trend.

"MSX users will tend to be older, more likely a 25 year old who wants something to match his hi-fi. He will be looking for more sophisticated software, maybe business packages. In the long term utility products won't sell, because MSX users will probably not be programmers at all, they will be purely software buyers, and computing will be software based."

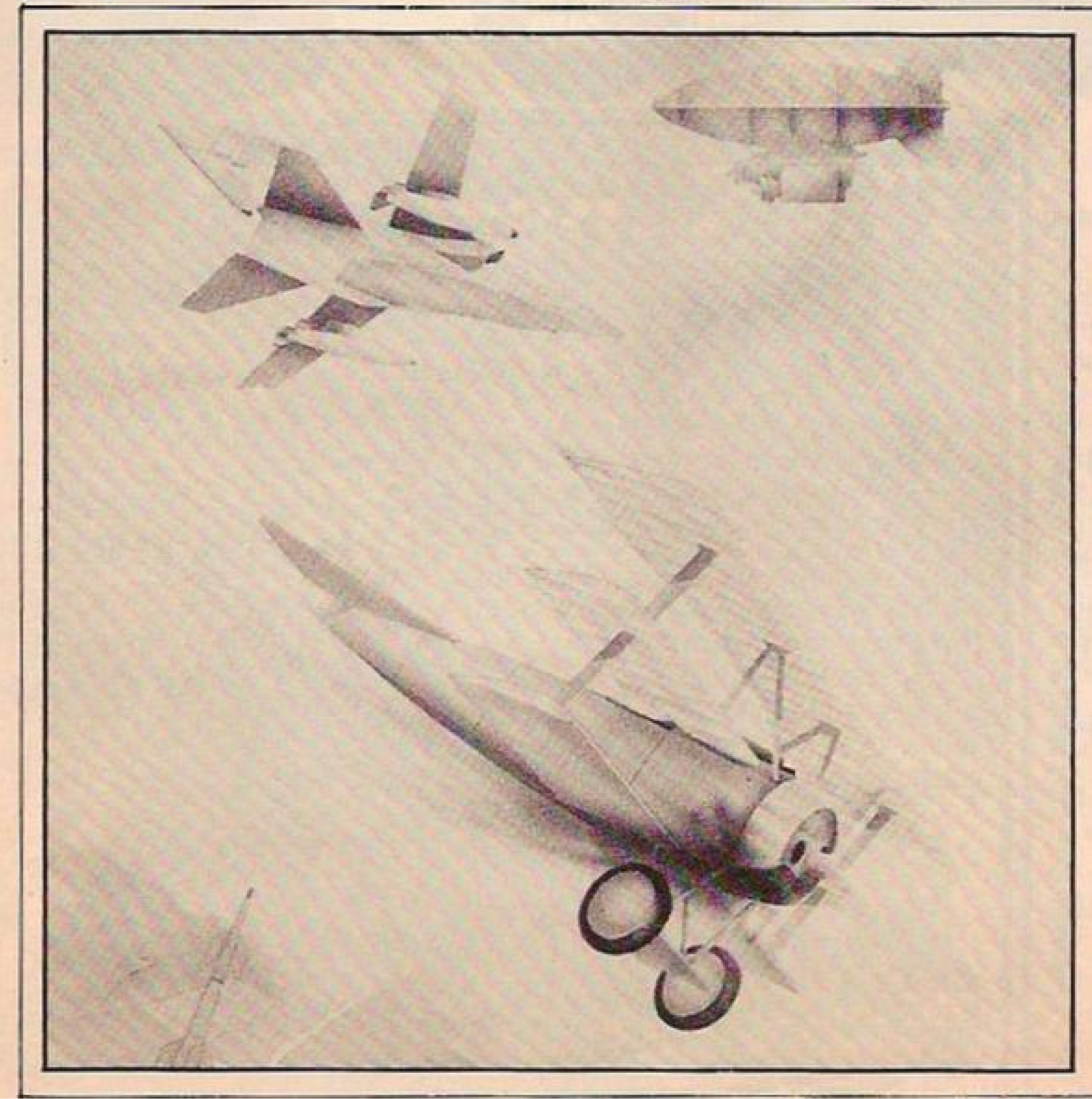
One good thing about MSX is that it is an international product, and there is a potential export market for shrewd software houses. PSS have already delivered product to France. As yet there is no MSX software market in the USA, because there are no MSX computers there yet. "Because we managed to get in so early it has had the side effect of letting us sell our back-catalogue to our newly found markets."

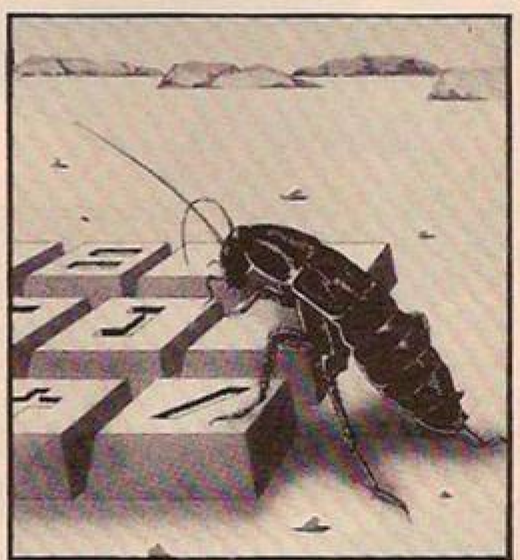
When MSX becomes a truly international product, it gives software houses a bigger market, this can only do them good. Currently PSS are exploring ways of making software multilingual, that is one program with software options for users in different parts of the world. But for the moment the French receive a slightly different version of existing games. The biggest problem at the moment is determining which languages to put on the cassettes.

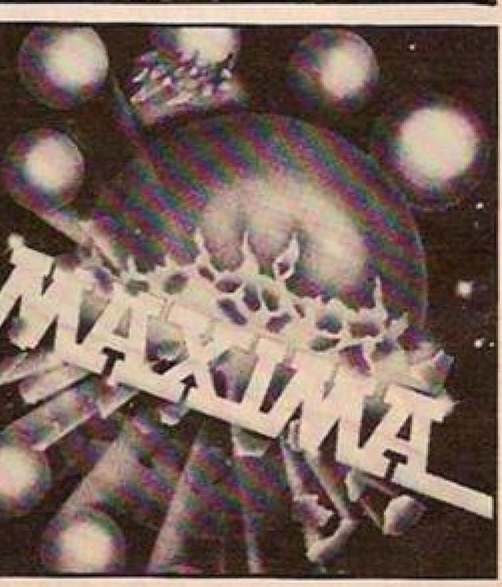
One of the problems that has dogged PSS from day one of the companies involvement in MSX was getting hold of machines. All the other software houses had the same problems, they simply were not around. As for technical help, the user group has been far more helpful than any of the existing manufacturers. All the UK manufacturers are to say the least "unhelpful". A rule of thumb is the more desperate a manufacturer is to have independent software houses writing for a particular machine, the more likely that company is to help. MSX manufacturers, through the user group have been the most helpful of all, which is a pointer to how important they see the software industry being.

"The Japanese have been the first people to accept what software houses have been saying all along", said Gary Mays, "that no matter how good a machine is, it ain't going to sell without software". On the other hand Amstrad has been encouraging software houses to write for the CPC 464, but insists on doing all the marketing. Giving a software house only a royalty. The MSX group provided software houses with technical manuals in fact the first technical manual PSS ever had from any source.

The key thing about MSX is that the group has managed to get software houses on their side. Something which nobody has bothered to do in the past.







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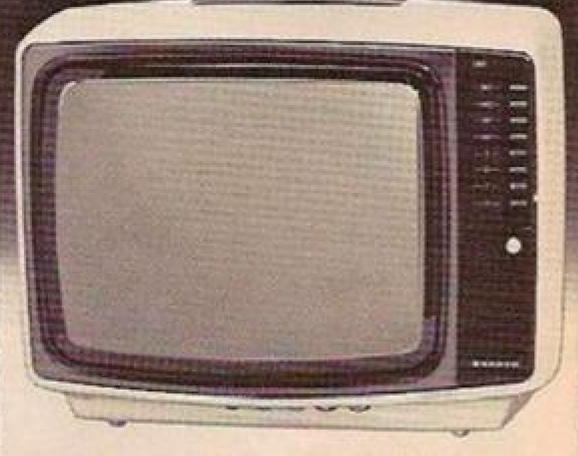
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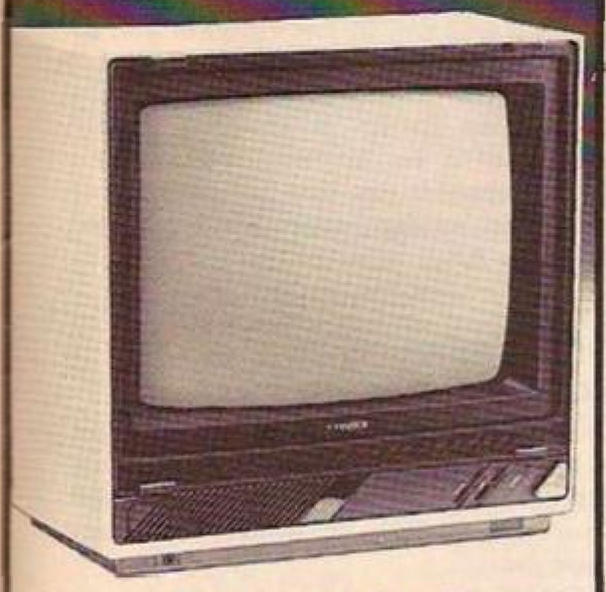
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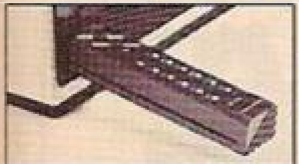
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SOFTWARE REVIEWS

(continued from page 6)

so often give out flames which also chase Sparkie. The flames cause Sparkie's fuse to burn, and all hell is let loose as Sparkie has to dash to a water bucket to douse the fizzing fuse. As Sparkie progresses through the maze, it turns blue, and when the whole of the maze has been coloured, he moves on to another, yet harder maze.

This game is not to everybody's taste. It is a bit cute, but it will go down well with families. As an example of Japanese programming, it is impressive. Best of all is the colourful moving graphics, and the oriental music. Sparkie is hot stuff.

Rating ****

Hyper Olympics
Konami

SUDDENLY THE whole world is athletics crazy. And so are computer games freaks. All over the western world one arcade game dominated the summer. "Track and Field" could be found in pubs, clubs and railway buffets everywhere. Now MSX users can join in the fun in the comfort of their own homes with the three new Hyper Olympic products from Konami.

Hyper Olympics is such a complex game that it comes in two parts, or rather comes on two cartridges. The third part is a special two-button playing device which allows you to really punish the buttons, in the same way that it is possible to hammer the arcade version. This device is called the "Hyper Shot", and simply plugs into the MSX joystick port. I found that it greatly improved my scores, and saved me from totally destroying my stock of joysticks, which can also be used to play the games.

The games included on the two cartridges will be familiar to fans of the arcade version. Cartridge one has 100m Dash, Long Jump, Hammer Throw and 400m Run. The second cartridge contains 110m Hurdles, Javelin Throw, High Jump and the 1500m Run. Unfortunately you have to play the game in two separate parts, but that doesn't seem to spoil the fun.

Each of the events in the Hyper Olympics is a separate game. You have to reach the qualifying standard, be it a time or a distance, to be able to move on to the next event. As you progress through the game your score appears to multiply, depending on how well you perform at each event.

In running events speed is governed by the rate at which you thump the run key, or wiggle the joystick. In field events you still have to control speed, but you also have to control the jump or throwing trajectory. This is done by holding down the jump button, or pressing the fire button on the joystick.

If Hyper Olympics is typical of the software that is going to appear on MSX cartridges, then the new Japanese standard will be a great success.

Rating ****

Buzz Off
Electric Software

BERTIE THE Fly loves eating fruit and buzzes around the screen eating the goodies. The trouble is each time he eats a piece of fruit he generates a new piece of web which is fatal if he touches it. This gets to a point, usually sooner than later, where it is nearly impossible to eat anymore fruit without getting trapped in your own web; some sort of meaningful message about greed perhaps?

Rating **

Oh Mummy
Eclipse Software

ON WITH THE Pith Helmet and off for a spot of troggling around pyramids. In much the same manner as painter, you have to go round squares to fill them in while other things chase you.

Rating *

The price tag. It's something rather special.

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